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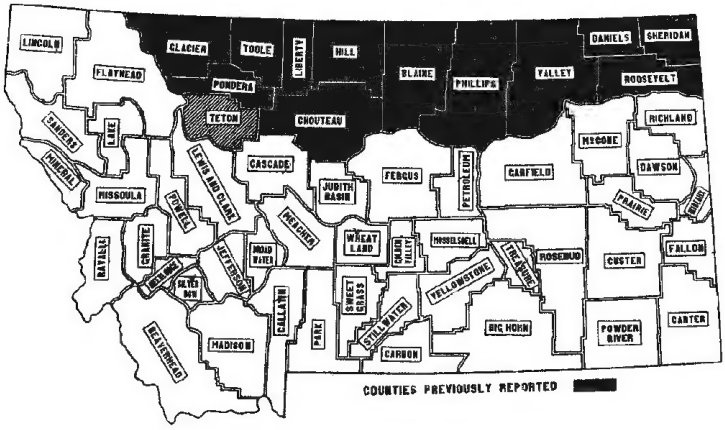
Soils Of Teton County



Soil Reconnoissance Of Montana

PRELIMINARY REPORT

BY

L. F. GIESEKER

IN CHARGE OF SOIL SURVEY

COOPERATING WITH THE BUREAU OF CHEMISTRY AND SOILS
UNITED STATES DEPARTMENT OF AGRICULTURE

MONTANA STATE COLLEGE
AGRICULTURAL EXPERIMENT STATION
BOZEMAN, MONTANA

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LOCATION

Teton County is located in the northwestern part of Montana, southeast of Glacier National Park. It is bounded on the south by Sun River and on the west by the continental divide and Sun River. The county has a maximum width of 42 miles and an extreme length of approximately 72 miles and covers an area of 2,295 square miles lying between Townships 20 and 28 North of Base Line Montana and Ranges 3 East and 11 West of the Principal Meridian Montana. Created in 1893, Teton County was later subdivided to form Toole, Glacier, and Pondera counties. Its present boundaries enclose a fairly compact agricultural area, in which some of the more important dry and irrigated lands in the state are located.

PHYSIOGRAPHIC FEATURES

The greater part of Teton County covers a transitional area between the Great Plains to the east and the mountains to the west. The mountains, formed by a fault, rise abruptly, and are without a distinct foothill section. Gravel-capped plateaus, traversed by wide stream valleys and often eroded into flat-topped gravelly ridges, extend east from the mountains for 40 miles. These plateaus have plain surfaces and slope east from elevations of 4,800 to 5,100 feet down to 4,000 to 3,900 feet. The surfaces of the plateaus are 300 to 600 feet above the level of the larger streams and have about the same grade as the present stream valleys. The eastern part of the county is a rolling, drift-covered plain, dissected by deep stream valleys. Several large glacial lake basins extend south through the central part.

Glaciation.—During the Late Wisconsin Glaciation, the main divide of the Rocky Mountains was a collecting ground for glaciers. The Sun and Teton river glaciers were the largest and most important in Teton County. The Sun River glacier pushed east 8 to 10 miles from the mouth of the Sun River canyon and deployed below the high plateau east of Pishkun Reservoir and along Deep Creek, while the terminal moraine of the Teton River glacier is within 4 to 5 miles of the Teton River canyon. Smaller glaciers also pushed out of Deep, Blackleaf, and Dupuyer canyons, but these glaciers extended only a short distance below their mouths. The stony, morainic ridges of the Blackleaf glacier are among the highest on the eastern slopes of the mountains. The Keewatin or continental ice sheet covered the eastern part of the county. It developed below Porter and Burton benches and extended up Teton River to within a few miles of Choteau. It passed through

the gap in the Teton ridge south of Dutton and covered the area east of the Great Northern Railway.

The eastern limits of the mountain glaciers are defined by high stony morainic ridges, back of which often lie recessional ridges, separated by gravelly lake basins. The drift is very stony and hummocky and near the mountains consists largely of limestone, multicolored argillites, and quartzites. The drift is of variable depth and covers an area ranging in elevation from 4,400 to 5,100 feet.

The western limits of the continental ice sheet are not so well defined since locally the drift is covered with glacial lake silts and clays and in the uplands is often shallow. The drift-covered areas have a billowy topography, characterized by low mounds, ridges, and potholes. There is a pronounced morainic relief west of Collins and Brady and also on the slopes of the Teton ridge, on the divide north of Teton River, and along Teton River west of the mouth of Muddy Creek. Granitic rock composes many of the boulders, and fragments of shale and sandstone of local origin usually are found in the debris. In the eastern part of the county the drift is 20 to 30 feet deep and in some of the preglacial stream valleys it is 80 to 100 feet. The continental ice sheet in Teton County covers an area having an elevation of 3,300 to 3,600 feet.

Glacial Lake Basins.—The damming of the mountain streams by the continental ice sheet formed large glacial lakes in the central part of the county. The alluvium deposited in these lakes has a maximum thickness of over 80 feet and lies between 3,750 and 3,950 feet in elevation. The glacial lake deposit in the basin west of Bole consists chiefly of silty clays and clays, but on the Burton Bench, north of Choteau, it ranges from loose limestone gravels to gravelly, silty clays. Glacial lake and stream deposits modify the character of the drift in Teton Valley, east of Choteau. Outwash gravel from the mountain glaciers covers large tracts in the valleys of the Teton and Sun rivers and also locally underlies the glacial lake silts and clays.

Mountains.—The Lewis range of the Rocky Mountains extends southward and forms the continental divide in this part of the state. The mountains rise 2,000 to 4,000 feet above the plateaus and are eroded into sharp, barren peaks and serrated ridges. Among some of the more prominent peaks and ridges rising above the tablelands are Dupuyer, Frazier, Ear, and Sawtooth. These peaks and ridges range in elevation from 7,500 to 8,000 feet and lie 1,000 to 2,000 feet lower than those on the continental divide. The rocks found in the mountains consist largely of limestone, multicolored argillites and quartzites of the Carboniferous and Jurassic ages. Intrusions of diorite occur in these sedimentary formations on the continental divide. The eastern slope of the

mountains are lightly covered with lodgepole pine and quaking aspen.

Greenfield Bench, Spring Valley, and Sun River Slope.—A high plateau, rising within 8 to 12 miles of the mountains and lying 1 to 6 miles north of Sun River, extends east into Cascade County from the southern part of Teton County. It has an elevation of 3,800 to 4,700 feet and its protective covering consists largely of red quartzite and argillite gravel and rock. Its gravelly slopes, indented with short deep coulees, rise steeply 75 to 150 feet. The eastern half of the plateau, known as Greenfields Bench is about 18 miles long and 6 to 8 miles wide. It has three distinct levels or slopes, the highest of which occurs on the south above Sun River and the lowest on the north along Little Muddy Creek. The highest level, carrying more rock on the surface and lying above the irrigation canals, is about 2 miles wide and broadens out to the east along the Cascade County line. The different levels have plain surfaces except for low gravelly bars on the higher areas. The eastern part of the bench is quite gravelly and above Little Muddy Creek is broken with deep coulees. Dark-colored shales underlie the gravelly wash on the slopes of the bench, except on the west where sandstones form an escarpment.

The western half of the plateau is very irregular and covers an area 18 to 20 miles long by 8 miles wide. In Range 6 West, this portion of the plateau has four different levels sloping to the south and east. The highest level extends east into Range 5 West and then swings to the northeast to form the narrow gravel-capped ridge and buttes on the divide south of Deep Creek. The two central levels break to the east into a basin known as Spring Valley, lying between two stony flat-topped gravelly ridges. The basin is 6 to 7 miles long and 2 miles wide. The lowest level, connected with Spring Valley by a gap, is known locally as Sun River Slope and is approximately 12 miles long and 2 miles wide. Sandstones underlie the gravelly wash on the slopes of the plateau except on the west where drift covers the slopes. Rocks 3 to 6 inches in diameter are abundant in the western part of the plateau and also on the Sun River Slope. South of Greenfield Lake the plateau is less than one mile wide.

Bole Bench.—The bench usually referred to as Bole Bench lies north of Greenfields Bench. It has an extreme length of 8 miles and a maximum width of 4 miles. It is also capped with red quartzite and argillite gravel and slopes to the southeast as a narrow gravel-capped ridge. Dark-colored shales outcrop on its northern and eastern slopes, which rise steeply to a height of more than 100 feet. The lower part of the bench east of Bole is rolling and above Little Muddy Creek is eroded into gravel-capped hills and ridges.

Porter Bench.—In the northern part of the county is another high plateau, extending east from the mountains for about 30 miles. It is eroded into isolated, irregular benches and long narrow ridges by intrenched stream valleys. These detached benches and ridges are between 4,000 and 5,000 feet in elevation and slope east into Pondera County at approximately the same grade. Argillite gravel and rock, larger and more abundant within 8 to 10 miles of the mountains, compose most of the protective covering on the plateau. The borders of the benches are indented with deep coulees and their gravelly slopes are usually very steep.

The portion of the plateau east of Dry Fork of Marias River is known as Porter Bench. It lies above a bold sandstone escarpment rising 200 feet or more above the valley of Dry Fork of Marias River. The bench is about 18 miles long and 1 to 5 miles wide and lies at an elevation of 4,000 to 4,500 feet. The eastern part of the bench is dissected by deep coulees, such as Farmers, Spring and Pondera. The slopes of the bench are very steep and on the north and east shales and sandstone outcrop locally below the gravelly wash. The bench has a smooth surface, except for an occasional gravel bar. The southwestern part of the bench carries a fair amount of rock on the surface.

Other Plateaus or Benches.—Along the base of the mountains are other plateaus or benches lying 200 to 300 feet lower than the high plateaus and extending east for 6 to 15 miles. The protective covering on most of these benches is quartzite and argillite, although on some of them dark-colored, resistant limestones are conspicuous. A dissected stony bench, 6 to 7 miles long and 2 miles wide, lies west of Bynum Reservoir and slopes east from an elevation of about 4,900 feet. Along Muddy and Blackleaf creeks, also, are small gravel-capped benches rising above the gravelly outwash of the Blackleaf glacier. South of Teton River are other stony benches on the lower slopes of the mountains. The rocks found on these benches are similar to those found in the mountains.

Deep Willow Creek Bench.—A large, gently sloping bench lies between Deep and Willow creeks in the southwestern part of the county. It is 12 to 13 miles long and 3 to 4 miles wide and lies at an elevation of 4,000 to 4,600 feet. The seeped drainage courses are not deeply intrenched. The surface of the bench is quite stony and the subsurface gravels are firmly cemented. The rock and gravel consist chiefly of quartzite and argillite. Small benches of similar character lie east of Willow Creek and south of Deep Creek.

Burton Bench.—A glacial lake and stream deposit covers a low bench in the north-central part of the county. The area, known as Burton Bench, north of Choteau, is 12 miles long and 3 to 9 miles wide. It slopes gently to the east from an elevation

of approximately 4,000 feet and is characterized by a low swell or ridge, rising 10 to 30 feet, northwest of Farmington and by several poorly drained basins in the eastern part. The land along Muddy Creek east of Bynum slopes away from the stream for ½ to 1½ miles. The glacial lake deposit consists of silts and clays overlying wash gravel. The gravels exposed on the western and southern parts of the bench consist of limestone and in the vicinity of Koyl the gravel deposit is 80 feet thick. Wash gravel underlies the glacial silts and clays in the eastern part of the bench and probably is the source of the artesian water found below the drift east of the bench. Drainage has not developed on the bench.

Valley Trains and Outwashes.—Outwash gravel from the Teton glacier covers the valley of Teton River in the western part of the country. The outwash north of the river extends east from the moraines for 6 miles and averages between 2 and 2½ miles wide. It grades into a swampy, gravelly depression connected by a gap through the sandstone escarpment with Burton Bench. West of the gap the depression is separated from the recent flood plains of the Teton River by a low gravel-capped bench. A low gravelly, sandy terrace, covered with willows and cottonwood, borders the stream on the south for 4 or 5 miles east of the morainic area.

Outwash gravel from the Blackleaf and Muddy Creek glaciers also covers a large area between Blackleaf and Muddy creeks. The gravel covering is not uniform and residual material derived from the underlying sandstones and shales locally outcrops on the low divides between the intermittent streams entering the creeks. A swamp, covering about 8 square miles, lies below the moraines of the Blackleaf glacier. Other swampy tracts occur above the junction of the two streams west of a low sandstone bench.

Outwash from the Sun River glacier covers several square miles along Sun River in Range 6 West. The barren limestone gravelly flat grades into a low bench rising 40 feet or more above the river and extending east for 10 miles. The bench averages 1½ miles wide and locally is covered with wash gravel from the high plateau on the north.

West of Longs Ridge in Range 8 West is a basin covered with semi-consolidated outwash gravel from the Deep Creek glacier. It lies at an elevation of 5,000 feet and covers 4 to 5 square miles. A gap between the barren sandstone buttes and ridges connects the basin with the large bench lying between Deep and Willow creeks.

Teton Ridge.—The divide in the east-central part of the county, south of Teton River, is capped with semiconsolidated quartzite gravel and rock. This divide, known as Teton Ridge, begins within 10 miles of Choteau and extends east almost to the county line. It rises several hundred feet above the valley of Teton River and is one of the more prominent physical features in the

eastern part of the county. South of Dutton the railway passes through a gap in the ridge, east of which the gravels are exposed on the higher hills and ridges above the drift-covered area.

Ben English and Other Buttes.—Several short ridges, capped with a fossiliferous limestone, rise 200 to 300 feet above the gravel-capped plateau in the northwestern part of the county. These ridges, known as Ben English Buttes, in T. 27 N., R. 8 W., have an elevation of 5,000 to 5,200 feet and are eroded into narrow ridges, separated by deep basins. Their slopes are steep but not broken badly with coulees. Isolated, gravel-capped buttes and sandstone ridges occur in the west-central part of the county south of Teton River. The buttes and ridges are prominent physical features in the area.

Escarpments.—A bold sandstone escarpment through which the mountain streams have cut passages extends northwest through the central part of the county. This escarpment borders the glacial lake basin on the west and rises 100 feet or more above Burton Bench, the valley of Teton River in the vicinity of Choteau, and the basin in which Greenfields Lake is located. It is capped with a resistant sandstone, slabs and fragments of which are found in the broken uplands above the escarpments. Priest and other buttes south of Choteau are capped with the same sandstone. North of Lake Creek in the southeastern part of the county is an eroded shaly escarpment, above which lies a drift-covered area. It rises more than 50 feet above the valley of Lake Creek.

Willow Creek Dome is a geologic structure 9 miles west of Choteau which rises several hundred feet above the surrounding area. The dome has a sandstone cap and its shaly slopes are gullied. Small tracts of quartzite gravel occur on the northern slope.

Badlands and Badland Basins.—In different parts of the county exposures of soft shales are eroded into barren gullied clay hills and ridges. The larger tracts are found (1) southeast of Ben English Buttes, (2) on the western slopes of Willow Creek Dome, and (3) locally, below the shaly escarpments. The sandstones on the Willow Creek divide, south of Choteau, are eroded badly and approach the character of badlands.

Badland basins or alkali flats cover the western part of the valley of Lake Creek and also are found in the valleys of Willow Creek and other streams in the west-central part of the county.

Waste Land.—The sandstone and shaly ridges and buttes are quite barren along the base of the mountains between the Teton and Sun rivers. These rock outcrops are designated as waste land on the maps.

Preglacial Valleys and Gaps.—The preglacial course of some of the larger streams, which would have a bearing on the drainage of the irrigated lands and also on the artesian water, are not

well defined in the central part of the county. Gaps and basins occur locally, but the configuration of the glacial lake and drift deposits does not show the location of many of the preglacial valleys. Artesian water is found east of Burton Bench in a gravel deposit below the drift. Little Muddy Creek heads in a gap, which was probably an outlet for the glacial lake during the time Teton River was dammed with ice. Ralston Gap is a glacial stream course through the moraines east of Burton Bench. Other ancient stream courses are found in the glaciated area north of Sun River.

DRAINAGE

Teton County lies in three drainage basins—the Marias, the Teton, and the Sun River. The high plateau in the northern part of the county separates the Teton and Marias drainage basins and the plateau in the southern part, the Teton and Sun River. Most of the county lies in the drainage basin of the Teton River and its branches. The larger streams are at flood stage during the spring runoff and again in May and June when they are swollen by the seasonal rains and melting snows in the mountains and on the high plateaus and divides.

MARIAS RIVER DRAINAGE BASIN

Several townships in the northwestern and north-central parts of the county lie within the Marias River drainage basin. The more important streams heading in the mountains and on the high tablelands and entering the Marias River and its branches are Dupuyer Creek, Dry Fork of Marias River, and Spring and Pondera coulees.

Dupuyer Creek is formed by its forks heading on the continental divide and uniting below high stony benches on the eastern slopes of the mountains. The forks are perennial streams which flow through deep wooded canyons. Below the benches the narrow valley of Dupuyer Creek is entrenched between high gravel-capped ridges and buttes.

Dry Fork of Marias River and its upper branches head on the eastern and northern slopes of Ben English Buttes and flow northeast into Pondera County. This stream and several of its branches have a small perennial flow. Its narrow valley is deeply entrenched in the high tablelands and west of Porter Bench rugged sandstones are exposed on the slopes.

Spring and Pondera Coulees are small perennial streams heading on Porter Bench. Spring Coulee, draining the north part of the bench, flows northeast through a wide gravelly basin, and Pondera Coulee, draining the eastern part, flows east through a narrow deep coulee. Other streams rising on the bench are intermittent, but some of them have perennial springs along their course.

TETON RIVER DRAINAGE BASIN

The Teton River drainage basin, covering the central part of the county, lies between high plateaus in the western part and the Teton ridge and a morainic divide in the eastern part. Teton River flows east and empties into Marias River in Chouteau County. The larger streams entering Teton River in the county are Muddy and Deep creeks. The larger branches of these streams are respectively Blackleaf and Muddy.

Teton River.—North Fork of Teton River heads on the continental divide in the northeastern part of the county and flows southeast through a wooded basin. South Fork rises on the eastern slopes of a low divide east of Sun River and flows east, uniting with North Fork below the mountains to form Teton River. East of the mountains, the stream drains a morainic area and a wide outwash gravelly flat. The poorly drained sandy, gravelly terrace on which Spring Creek is located rises above the stony river wash east of the moraines, south of the river. East of the terrace and outwash flat, the stream has eroded a valley less than ½ mile wide through the sandstone escarpment. Below the escarpment, northwest of Choteau, its course is to the south and east around Burton Bench through a poorly drained valley 1 to 3 miles wide. Southeast of Choteau the streams enter a wide drift-covered basin extending east to the county line north of Teton Ridge. Its valley averages about ¼ mile wide and is intrenched 50 to 75 feet or more in the basin. During low water, Teton River is a swiftly flowing stream 30 to 40 feet wide and 1 to 3 feet deep. Its recent flood plain in the western part of the county largely consists of stony river wash.

Muddy Creek, a perennial stream, heads on the eastern slopes of the mountains and flows east, entering Teton River east of Collins. Below the mountains the stream drains a morainic and swampy outwash area before cutting through the sandstone escarpment west of Bynum in a valley less than ½ mile wide. The stream meanders through the Burton Bench, east of which its narrow valley is deeply entrenched in the drift-covered uplands. Its recent flood plains are very gravelly and poorly drained west of the drift-covered area. Farmers Coulee, rising in a small basin in the western part of Porter bench, flows southeast through a deep wide coulee and enters Muddy Creek above the county line.

Clark Fork of Muddy Creek also rises on the eastern slopes of the mountains and flows east, entering Muddy Creek west of Bynum Reservoir. It is an intermittent stream draining several stony benches and a poorly drained alkali basin between sandstone escarpments west of the reservoir.

Blackleaf Creek is another small perennial stream heading in the mountains and flowing east, entering Muddy Creek west of Bynum. It drains an outwash gravelly area south of the stream,

gravel-capped benches, and a rolling residual area underlaid with sandstones and shales on the north. Its poorly drained valley is not deeply entrenched.

Deep Creek, one of the largest perennial streams in the county, is formed by the union of several fair-sized mountain streams in the southwestern part of the county. The stream flows through a narrow valley entrenched 75 feet or more below the uplands and enters Teton River south of Choteau. East of the mountains it drains a broken sandstone area, a gravel-capped bench lying north of the moraines and a rolling residual sandstone section above the sandstone escarpment.

Willow Creek, another perennial stream heading in the mountains, flows southeast and enters Deep Creek in Range 5 West. East of the mountains its branches drain several swampy basins below stony benches and high sandstone ridges. East of these ridges it flows below the broken slopes of Willow Creek Dome and cuts through a gravel-capped bench to enter Deep Creek. Its valley is not so deeply intrenched as that of Deep Creek.

SUN RIVER DRAINAGE BASIN

The Sun River drainage basin lies south of the high plateau and the Teton ridge in the southern part of the county. Sun River is one of the largest streams in north-central Montana and flows east, entering Missouri River south of Great Falls in Cascade County. Little Muddy Creek is its largest branch in Teton County.

Sun River.—North Fork of Sun River, forming the western boundary of the county, rises on the continental divide and flows southeast through a wooded mountain basin. Below the mountains it unites with South Fork to form Sun River, which flows east, forming the southern boundary of the county. East of the mouth of the Sun River canyon its valley is a mile or more wide but narrows to the east below the moraines and outwash gravel deposits. Big Coulee, an intermittent stream deeply intrenched on the plateau, heads in Spring Valley and enters Sun River across the county line. The river and coulee drain the southern slopes of the plateau and a rolling residual sandstone area south of the plateau.

Little Muddy Creek, another intermittent stream, heads in a gap between the Greenfields and Bole benches. It flows east and southeast and empties into Sun River in Cascade County. The gap widens west of Power between the shaly breaks to form a broad alkali basin. The stream drains the northern and eastern slopes of Greenfields Bench and a rolling area covered with wash gravel and drift below Bole Bench and the Teton ridge. It receives the drainage from the irrigated lands on Greenfields Bench and during the irrigating season it has a fair flow.

Lake Creek, an intermittent stream rising east of Power, flows east through a poorly drained basin and empties into Benton Lake in Cascade County. It drains a shallow drift-covered area lying above a shaly escarpment and below the Teton ridge in the eastern part of the county.

SETTLEMENT

History.—The Blackfeet Indians, consisting of the Piegan and Blood tribes, were in possession of the area east of the mountains at the time of the Lewis and Clark Expedition to the Northwest in 1806. The Blackfeet Nation was hostile to American trappers and traders up to about 1842, at which time the American Fur Trading Company established a permanent post at Fort Benton in the Blackfeet territory. During the sixties and seventies, these Indians frequently attacked immigration trains moving through the area, also freight trains moving between Fort Benton and such mining camps as Virginia City and Helena.

Fort Shaw, a military post, was established on Sun River, south of Fairfield, in 1867 to protect traffic. Soon after this fort was established, cattle were driven into the area from the Texas plains. The present boundaries of the larger Indian reservations in northern Montana were not established until about 1885. A short time after the Indians were placed on the reservations, Fort Shaw was converted into an Indian school, which was in operation until about 1910.

Most of Teton County was sectionized during the nineties.

Trapping and trading with the Indians were the chief industries in this part of the state for many years after the Lewis and Clark Expedition. Temporary trading posts, around which some of the local towns have sprung up, were established at such points as Dupuyer, Choteau, and Fort Shaw. Other points also were established on the slopes of the mountains in Teton county. The early freight trails from Fort Shaw through Choteau to Blackfeet in Glacier County still may be located by the deep wagon ruts on the unbroken plateaus.

Petroleum was discovered in the Bannatyne field east of Collins in 1927. The field is undeveloped. Natural gas also is found in commercial quantities in the area.

Time of Settlement.—The first permanent settlements in the area were made by squatters around military forts and trading posts, and by stockmen who generally located on the larger streams and in the foothills of the mountains. Although the unreserved public lands were opened for settlement in 1887, most of the settlement occurred between the years of 1910 and 1915. Irrigation was developed by the early stockmen in the stream valleys and on some of the lower benches during the late eighties and nineties,

but most of the larger projects were not undertaken until after 1900.

Nationality of Settlers.—Many of the early livestock companies were managed by Englishmen and Scotchmen. The people attracted to this part of the state during the dry-land movement came chiefly from the industrial centers and agricultural districts of the north-central states. The more recent settlers on the irrigated projects have come from Utah and Idaho. On the ceded strip in the western part of the county are a small number of half-breed Indians, and in the larger towns a few Japanese, Chinese, and Negroes are found.

Population.—The area was sparsely settled during the time that stock raising was the chief industry, but with the settlement of the dry and irrigated districts between 1910 and 1917 the farm and urban populations grew rapidly. The census report for the year 1930 gave Teton County a total population of 6,038, of which approximately 60 were colored. The farm population in 1935 was placed at 4,041, of which 27 were colored.

Towns.—Choteau, the county seat, is located in the central part of the county on branch lines of the Great Northern and the Milwaukee railways. It has a population of 917 and serves a large stock-raising and farming section. Pendroy, Bynum, and Bole are important trading centers on the Great Northern and Agawam, Farmington, and Fairfield on the Milwaukee. Pendroy and Agawam are respectively the terminals of the Great Northern and the Milwaukee branch lines. In the eastern part of the county, Collins, Dutton, and Power, located on the Great Falls-Shelby connection of the Great Northern Railway, serve agricultural sections. Dutton, Fairfield, and Power have populations of 150 to 250, and the other towns less than 100.

The larger towns have many of the modern municipal improvements, such as electric light, water, and sewerage systems. The educational facilities in the larger towns are good, but in some of the more remote agricultural and stock-raising districts they are often below state standards. The towns located on the railways are served by the power and telephone companies.

Transportation and Markets.—The Great Falls-Shelby connection of the Great Northern Railway, constructed as a narrow-gauge road during the early nineties, runs through the eastern part of the county. The Great Falls-Agawam branch of the Chicago, Milwaukee, St. Paul and Pacific Railway and the Power-Pendroy branch of the Great Northern Railway, constructed respectively in 1917 and 1913, serve the central and western parts. The railways provide facilities for the shipment of grain to eastern and western markets, such as St. Paul, Chicago, Portland, and Spokane. Most of the exports consist of grain, livestock, and livestock products. Local markets for perishable farm products are

limited as Great Falls and Butte are the largest receiving points within reach in the western part of the state.

U. S. Highway No. 87, known also as the Yellowstone-Glacier Park Trail, extends from Great Falls through Fairfield and Choteau to Browning in Glacier County. The Great Falls-Shelby highway, one of the improved state highways, parallels the railway in the eastern part of the county, and the Augusta-Choteau highway leads south to Helena. These highways are surfaced with crushed gravel and are maintained in fair condition during the tourist season. The larger towns and many of the rural districts are connected by improved dirt roads, which often become very dusty and rutty during the summer and fall. Other upland trails are passable the greater part of the year.

LEWIS AND CLARK NATIONAL FOREST

The western part of Teton County lies within Lewis and Clark National Forest. This mountainous area has a fair timber cover and is open for grazing between June and September. Grazing permits on the National Forest are obtained from the forest supervisor, located in Helena.

STATE LANDS

There are approximately 81,000 acres of state land in Teton County. The sale and lease of these lands are in charge of the Registrar of State Lands, Capitol Building, Helena. A minimum price of $10 per acre has been placed upon these lands by the state legislature.

CLIMATE

The climate of Teton County is semiarid. It is influenced by the varying altitude and by the mountains to the west. The lower plains have a comparatively low rainfall, great temperature extremes, large number of sunshiny days, and a low relative humidity. The midsummer temperatures are not oppressive because of the low humidity, and the winter extremes are not especially severe, as the cold waves are not often accompanied by strong winds.

Tables 1 and 2 give the normal monthly, seasonal, and annual temperature and precipitation at Augusta, Blackleaf, Choteau, Fort Shaw and at Lytle, located in the southeastern corner of Pondera County. The stations range in elevation from 3,435 feet in the lower plains at Lytle to 4,200 feet on a high bench below the mountains at Blackleaf. Fort Shaw, Choteau and Augusta range from 3,502 to 4,071 feet in elevation.

Temperature.—The average annual temperature for the different stations ranges from 38.5° F. at Blackleaf to 44.0° at Fort Shaw, increasing to the east and also to the south along the base

TABLE 1.—TEMPERATURE RECORDS AT AUGUSTA, BLACKLEAF, CHOTEAU, F
DATA FROM UNITED STATES WEATHER BUREAU RECO

	Mean					Absolute maximum					
	Augusta 1896-1935	Black-leaf 1905-1920	Choteau 1890-1930	Fort Shaw 1867-1927	Lytle 1912-1935	Augusta	Black leaf	Cho-teau	Fort Shaw	Lytle	Au
December	24.7	20.8	24.5	25.4	23.1	63	60	78	74	57	
January	19.0	16.2	20.6	21.0	17.1	66	62	79	67	69	
February	21.8	17.6	22.6	23.6	19.9	65	65	64	71	54	
Winter	**21.8**	**18.3**	**22.6**	**23.3**	**20.0**	**66**	**65**	**79**	**74**	**69**	
March	30.9	52.8	21.8	33.3	30.0	75	75	82	81	71	
April	41.9	38.1	42.4	44.6	43.0	89	84	85	93	82	
May	49.3	45.7	51.4	51.6	52.0	94	93	92	98	102	
Spring	**40.7**	**36.6**	**38.5**	**43.2**	**41.7**	**94**	**93**	**92**	**98**	**102**	
June	56.5	54.1	59.5	60.4	60.9	99	90	96	101	102	
July	62.6	60.2	65.1	66.6	67.7	100	96	101	112	105	
August	60.9	58.2	63.1	64.8	65.9	97	95	98	102	100	
Summer	**60.0**	**57.3**	**62.6**	**63.9**	**64.8**	**100**	**96**	**101**	**112**	**105**	
September	53.2	51.2	64.4	56.0	55.8	92	94	92	94	94	
October	44.5	42.8	44.4	44.0	45.4	84	86	86	93	92	
November	32.2	30.9	33.2	36.4	33.9	74	82	77	74	70	
Fall	**43.3**	**41.6**	**44.0**	**45.5**	**45.0**	**92**	**95**	**92**	**94**	**94**	
Annual	**41.5**	**38.5**	**42.7**	**44.0**	**42.9**	**100**	**96**	**101**	**112**	**105**	

TABLE 2.—PRECIPITATION RECORDS AT AUGUSTA, BLACKLEAF, CHOTEAU, I
DATA FROM UNITED STATES WEATHER BUREAU RECO

	Total amount driest year (inches)					Total am	
	Augusta 1904	Blackleaf 1914	Choteau 1905	Fort Shaw 1874	Lytle 1919	Augusta 1927	Blackl 191
December	0.40	0.19	T	0.25	0.49	1.76	0.24
January	21	.18	0.50	.29	T	1.22	1.41
February	.15	.23	.12	.20	.95	1.10	.20
Winter	**.76**	**.60**	**.62**	**.74**	**1.44**	**4.08**	**.85**
March	2.18	.54	.56	.38	.38	.64	T
April	.50	1.23	.55	.08	.09	.47	.57
May	.92	1.11	1.45	1.06	1.95	6.08	5.10
Spring	**3.60**	**2.88**	**2.56**	**1.57**	**2.42**	**7.19**	**5.67**
June	.99	3.07	2.63	1.14	.95	1.70	5.86
July	1.20	.34	1.25	.00	.01	2.96	2.86
August	.32	.63	.70	.24	.84	3.60	3.59
Summer	**2.51**	**4.04**	**4.58**	**1.38**	**1.80**	**8.26**	**12.31**
September	.16	.24	.27	.16	1.62	1.39	6.93
October	.10	1.76	.10	.08	.93	.72	1.42
November	T	.46	.26	.36	.32	2.36	1.52
Fall	**.26**	**2.46**	**.63**	**.60**	**2.87**	**4.47**	**9.87**
Total	**7.13**	**9.90**	**8.39**	**4.24**	**8.53**	**24.00**	**28.70**

TABLE 2.—(Continued)

	Mean (degrees Fahrenheit)					Snow	
	Augusta 1896-1935	Blackleaf 1905-1930	Choteau 1890-1931	Fort Shaw 1867-1927	Lytle 1912-1935	Augusta	Black
December	0.53	0.47	0.53	0.44	0.50	4.9	6.1
January	.64	.67	.68	.54	.60	8.0	9.1
February	.50	.56	.57	.45	.58	5.4	6.0
Winter	**1.67**	**1.70**	**1.78**	**1.43**	**1.68**	**18.3**	**21.3**
March	.90	.56	.65	.41	.55	7.6	6.2
April	1.13	1.07	.83	.65	.91	7.7	10.3
May	2.68	3.09	2.00	1.92	1.85	2.3	3.2
Spring	**4.71**	**4.72**	**3.48**	**2.98**	**3.31**	**17.6**	**19.7**
June	3.02	3.72	2.92	2.26	2.24	.0	T
July	1.83	1.55	1.75	1.31	1.45	.0	.0
August	1.21	1.55	1.28	0.96	1.37	0.1	T
Summer	**6.06**	**6.82**	**5.95**	**4.53**	**5.06**	**0.1**	**T**
September	1.44	1.94	.99	.98	.36	1.8	4.7
October	86	1.08	.74	.69	.74	6.0	9.4
November	.52	.65	.36	.34	.41	5.3	4.6
Fall	**2.82**	**3.67**	**2.09**	**2.01**	**1.51**	**13.1**	**18.7**
Total	**15.26**	**16.91**	**13.30**	**10.95**	**11.56**	**49.1**	**59.6**

of the mountains. January, with averages of 17.1° to 21.°, is the coldest month and July, with averages of 60.2° to 67.7°, is the warmest. Midsummer maximum temperatures of 100° to 102° have been recorded at all the stations except at Blackleaf. The lowest minimum temperatures range from —39.0° at Lytle to —51.0° at Augusta. The average frost-free period dates from early June to the last of September at the higher elevations and from early May to the middle of September at the lower elevations. Tmperatures of 32° or lower have been recorded at all the stations for every month in the year except for July at Choteau and Lytle. Lytle also reports the month of August as frost free. Spring grains are usually seeded in the eastern half of the county during the last of April or early in May. These grains rarely are injured by late spring frosts, but early fall frost may cause serious damage to small grains on the high plateau and also on irrigated areas.

Precipitation.—The precipitation in Teton County varies with the elevation and with the location east of the mountains. The average annual precipitation ranges from 10.95 inches at Fort Shaw to 16.91 inches at Blackleaf with an average of 13.37 inches for the three remaining stations. The precipitation reported for the driest years varies from 4.24 to 9.98 inches and for the wettest years from 17.19 to 28.70 inches at Fort Shaw and Blackleaf respectively. Sixty-five to 75 per cent of the total annual rainfall is received largely in small local torrential showers and in the more rolling sections the runoff is large. The annual snowfall is between 3½ to 5 feet except in Sun River Valley where the Fort Shaw records show it to be 28.6 inches. Table 2 shows the winter snowfall to be quite uniformly distributed between November 1 and April 1, but the annual records show great variations in the total amount and its distribution.

Winds.—Teton County is subject to brisk westerly and southwesterly winds which are usually stronger during the early spring months, and in dry seasons there is considerable damage to early seeded crops from soil drifting. Warm winds, known as chinooks, occur in this part of the state during the winter months and often melt the accumulated snow on the lower plains. In dry seasons, hot winds rise occasionally and cause serious crop losses on the dry land. Hailstorms of more or less severity occur locally during the summer months.

MAPS

The four maps accompanying this report show (1) the location and extent of the different soils, (2) the main physiographic and geographic features, (3) the location and percentage of each section under cultivation, and (4) the United States Geological Survey land classification which indicates the adaptation of the land to agriculture.

Soil Map.—The soil map shows the relationship of the soils in the different parts of the county. It is based on physical properties, such as texture, color, structure, thickness, and also on the relative position of the different horizons or layers found in the soils under field conditions. These horizons, which may be observed in road cuts and coulees, are the result of the natural soil forming processes, and have been influenced by such factors as climate, topography, vegetation, drainage, erosion, etc. Soils having the same profile, that is the same number, arrangement, and character of horizons, are divided into large groups known as the soil series, which are further divided into soil types on the basis of the proportion of sand, silt, and clay in the surface layers. Reconnoissance soil surveys deal largely with the identification and isolation of the larger soil groups—the soil series. Soil types are not easily isolated in traversing an area at intervals of two miles and on the soil map only the most prevalent types such as loams, sandy loams, etc., of each series are shown. Each type may therefore contain tracts of heavier or lighter soils and in some cases isolated areas of other soil series. Areas covered by mountains, badlands, and badland basins are not included in any of the soil series and are shown as physiographic features.

Topography.—The chief physiographic and geographic features of the county are shown on the topographic map. The location and extent of such geographic features as mountains, lakes, badlands, and the more important stream courses are represented. The general relief of the land is divided into the following phases: (1) undulating to rolling, (2) sharply rolling land or land too steep and broken for cultivation, (3) plateaus and benches, (4) mountains, (5) badland, and (6) badland basins.

Area Under Cultivation.—A record of the approximate acreage was made at the time of the survey for the purpose of locating the more intensely cropped sections, and for studying the conditions under which these sections are more favorably adapted to agriculture than others. The approximate percentage of each section in crop, in fallow, and in tame pasture is shown.

Land Classification.—The United States Geological Survey undertook a classification of the public lands in the western states in 1915 for the purpose of designating these areas in which 640-acre tracts could be homesteaded under the Stock Raising Act. This classification was based largely upon topography and vegetation and in no instance was any information obtained in regard to the soil relationships in any one county or between two or more counties.

The land classification map is of value in indicating the general adaptation of the land to agriculture. On the map the utilization of the land is indicated as follows: (1) farm lands, (2) farming-grazing land, (3) grazing-forage land, (4) grazing land, and

(5) nontillable-grazing land. Other features, such as the location of the irrigated districts also are shown.

DESCRIPTION OF SOILS

The regional profile of the soils of Teton County varies with the elevation and location. There is a transition in the soil profiles along the base of the mountains from north to south. The mature soils, classified according to color, belong to several groups, namely, grayish-brown, dark grayish-brown, very dark grayish-brown, black, and in the mountainous area probably some gray forested soils. The grayish-brown and dark grayish-brown soils with carbonate zones 6 to 15 inches below the surface cover the rolling plains and tablelands, having elevations of less than 4,300 to 4,500 feet. The very dark grayish-brown soils with carbonate zones below 15 to 40 inches occur on the higher tablelands and on the lower slopes of the mountains in the western part of the county. Black soils without carbonate zones are found on several high benches along Dupuyer Creek in the northwestern part. The grayish-brown and dark grayish-brown soils have developed under a short grass cover, a moderately low rainfall, and a wide range in summer and winter temperatures. The black soils have developed under a tall grass cover, greater rainfall, lower mean annual temperature, and short growing seasons. The very dark grayish-brown soils have developed under conditions intermediate between these two groups. Gray or immature soils without well developed horizons occur in the more eroded sections, such as south of Willow Creek Dome and below sandstone and shale escarpments.

The mature soils, developed over glacial drift in the plains of Montana, are grouped in three series, namely, Joplin, Scobey, and Williams. The soils of the Joplin series, representing the grayish-brown group with carbonate zones 8 to 12 inches below the surface, cover portions of the eastern part of the county; and those of the Scobey series, the dark-grayish-brown group with carbonate zones 10 to 15 inches below the surface, are found chiefly in the central part of the area. In Teton County, soils developed over glacial lake and stream deposits also are grouped in this series. The very dark grayish-brown soils of the Williams series are not represented in the county. The Joplin loams and silt loams are among the marginal agricultural soils in Teton County. These soils produce fair yields of spring wheat on summer-fallowed land in seasons of favorable rainfall. The tillable phases of the Scobey loams, silt and silty clay loams are productive and are well under cultivation. The deeper and darker colored phases of these soil types are among the best agricultural soils in Teton County. The Scobey silty clay loams and clay loams are rather heavy and refractory for dry-land farming, but under proper soil management they produce fair yields of small grains on

summer-fallowed land in seasons of normal rainfall. The non-tillable types, such as the Scobey stony loams, covering morainic areas, are well covered with grass and have a good livestock carrying capacity.

The Cut Bank series includes a group of grayish-brown soils with carbonate zones 6 to 8 inches below the surface. These soils have developed over glacial lake deposits, which have been modified by wash from the gravel-capped tablelands and from residual sandstone sections. The soils are somewhat shallow and low in organic matter for dry-land farming, but under irrigation they produce fair yields of small grains and forage crops.

The Phillips series includes a group of dark grayish-brown soils developed over poorly drained shaly drift. The soils of this series are characterized by the so-called "scab spots" or "blow out holes." The soils grouped in this series in Teton County cover largely scabby upland dry glacial lake beds. Many of these lake beds are too small to be shown on the map. The tracts are not under cultivation and are classified as low grade grazing land.

The soils, developed over calcareous sandstone and shales in Teton County, are grouped in the Bainville, Morton, and Teton series. The gray, immature soils of the Bainville series, often having the structure and stratification of the parent material below 3 to 5 inches, occur chiefly in the south-central part of the county. The land has a fair grass cover and a fair livestock carrying capacity. The more mature dark grayish-brown soils of the Morton series, with carbonate zones 8 to 15 inches below the surface, occur chiefly in the central part of the county above sandstone escarpments bordering the glacial lake areas. The less stony and broken phases of the Morton series are productive small grain soils and are well under cultivation. The land has a good grass cover and a high livestock carrying capacity. The very dark grayish-brown almost black soils of the Teton series, with carbonate zones 20 to 40 inches below the surface, cover several small areas in the northwestern part of the county. The land lies at a rather high elevation for farming and is used chiefly for the production of hay and for the grazing of livestock.

The soils developed over noncalcareous dark colored shales are grouped in four series, namely, Lismas, Pierre, Marias, and Power. The immature soils of the Lismas series, covering the shaly breaks of some of the larger streams, are without definite horizons and are among the poorest grazing lands in the county. The gray soils, composing the Pierre series, also are immature, but usually have a slightly calcareous mulch on the surface, below which the cloddy clays often have the platy structure of the parent shales at depths of 2 to 3 feet. These soils, occurring chiefly in the southeastern part of the county, have a low livestock carrying capacity. The dark grayish-brown soils of the

Marias series, effervescing with acid in all sections, cover several small basins and slopes in the eastern part of the county. These high lime soils are under cultivation and produce fair yields of small grains in favorable seasons, where the land has good drainage. The very dark grayish-brown soils of the Power series with carbonate zones below 18 inches cover a small basin in the southeastern part of the county. The land is all under cultivation.

The soils, developed on the gravel-capped benches and on the high tablelands, are grouped into four series according to the color and physical properties of the surface soils and the depth and cementation of the carbonate zone. These are, Croffs, Fairfield, Ashuelot, and Buffalo. The Croffs series includes a group of undifferentiated black stony soils, covering high tablelands below the mountains at elevations above 4,800 feet. The soils of this series, having deep carbonate zones in Teton County, are not under cultivation and are used for the grazing of livestock during the time snow does not cover the area. The Fairfield series comprises another undifferentiated group of dark grayish-brown and very dark grayish-brown soils, occurring on quartzite gravel-capped benches in the central part of the county at elevations between 4,000 and 4,800 feet. The soils of the dark-grayish-brown group, covering the lower benches such as Greenfields, Porter, and Bole at elevations of 4,000 to 4,500 feet, often have semicemented carbonate zones below 15 inches. These soils are among the best dry and irrigation farming soils in the area. The very dark grayish-brown group of soils with unconsolidated carbonate zones below 20 to 30 inches lie at higher elevations. These soils are quite stony and gravelly and above the ditch are used chiefly for the grazing of livestock. The dark grayish-brown soils of the Ashuelot series, covering the greater part of the Burton and Deep Creek benches, have firmly cemented carbonate zones and often cemented gravel blocks occur on the surface. The soils of this series are too droughty for dry-land farming and above the ditch are used chiefly for the grazing of livestock. The Buffalo series includes an undifferentiated group of dark grayish-brown and very dark grayish-brown soils occurring on eroded and gravel-capped ridges and buttes in different parts of the county. The land has a good grass cover and a fair livestock carrying capacity.

The Lowry and Cole series include two undifferentiated groups of soils developed over shallow gravel deposits and overwash gravel in the uplands and on the slopes of the gravel-capped tablelands. The dark grayish-brown soils of the Cole series differ from those of the Lowry series in containing more residual material derived from shales. The soils of the Lowry series are distributed over the western and southern parts of the county and are under cultivation where the land is not too gravelly and too steep. The soils of the Cole series are confined largely to basins

below benches in the southeastern part. The land above the ditch is not under cultivation.

The very dark grayish-brown soils, comprising the Cheyenne series, have developed over stratified gravel deposits occurring as secondary benches or terraces along some of the mountain streams in the central and western parts of the county. The soils of this series have well developed carbonate zones at 10 to 20 inches below the surface. These gravelly loams are rather droughty for dry-land farming, but under irrigation they produce fair yields of forage crops.

The soils of the Orman series have developed in old stream valleys and in old lake basins in the eastern part of the county. This grayish-brown group of soils have carbonate zones at 5 to 10 inches below the surface and the subsoils are impregnated with alkali. The soils are too heavy and impregnated with alkali for farming in Teton County and are used chiefly for the grazing of livestock.

The soils developed over recent stream deposits are grouped into the Laurel and Chouteau series. The Laurel series includes a group of undifferentiated gray, calcareous soils without distinct horizons, covering the stream valleys in the central and eastern parts of the county. In this series is grouped the stony river wash along the larger streams. Many of the upland stream valleys are impregnated with alkali and on the soil map the soils of these valleys are designated as an alkali phase of the Laurel series. The Laurel group of soils are locally under cultivation where the land is subirrigated or where it lies below the ditch. The Chouteau series includes a group of undifferentiated black stony soils, covering the poorly drained stream valleys below the mountains in the western part of the county. These wet bottoms often are valuable wild hay lands. In this series are grouped the black soils surrounding fresh water lakes and swamps.

Barren rock outcrops, stony moraines, gravelly outwashes, badlands, badland basins, and mountains are shown as physiographic features on the soil map. Swampy tracts, covered densely with willows, also are shown as physiographic features.

The soils of Teton County are grouped in 21 soil series and 52 soil types and phases. Table 3 gives the area in square miles of each soil type and physiographic feature and also the proportions of each soil type or phase, which is unsuitable for cultivation because of the broken topography.

JOPLIN LOAMS

The surface 1 to 3 inches of the Joplin loams north of Collins is a loose laminated light grayish-brown fine sandy mulch. The humus bearing layers are grayish brown friable columnar structured loams 4 to 6 inches thick. The shallow subsurface layer is

TABLE 3.—AREA IN SQUARE MILES AND PROPORTIONATE EXTENT OF EACH SOIL TYPE IN TETON COUNTY WITH TOPOGRAPHY

Soil series and types	Total area	Percentage of county	Topography	
			Level to sharply rolling	Sharply rolling
	sq. mi.	p. ct.	sq. mi.	p. ct.
Ashuelot series				
Ashuelot gravelly loams	36.6	1.7	36.6	0.0
" gravelly loams—cemented phase	52.8	2.3	52.8	0.0
" gravelly loams—swampy phase	51.2	2.2	51.2	0.0
" silt loams	10.6	0.4	10.6	0.0
" gravels	23.0	1.0	23.0	0.0
Bainville series				
Bainville loams	232.5	10.1	176.0	56.5
" silty clay loams	31.4	1.3	31.4	0.0
Buffalo series				
Buffalo loams	2.8	0.1	2.8	0.0
" stony loams	16.7	0.7	4.4	12.3
Cheyenne series				
Cheyenne gravelly loams	32.9	1.4	32.9	0.0
" gravelly loams—modified phase	5.0	0.2	5.0	0.0
Chouteau series				
Chouteau loams	64.9	2.7	64.9	0.0
Cole series				
Cole clay loams	3.6	0.1	3.6	0.0
Croffs series				
Croffs stony loams	56.7	2.4	56.7	0.0
" stony loams—dark phase	10.7	0.4	10.7	0.0
Cut Bank series				
Cut Bank sandy loams	4.4	0.2	4.4	0.0
" " silt loams	7.0	0.3	7.0	0.0
Fairfield series				
Fairfield loams	110.0	4.8	110.0	0.0
" loams—dark phase	83.9	3.6	83.9	0.0
" loams—rolling phase	9.4	0.4	9.4	0.0
" gravelly silt loams	15.0	0.6	15.0	0.0
" stony loams	27.9	1.2	27.9	0.0
Joplin series				
Joplin loams	53.9	2.3	49.7	4.2
" sandy loams	1.0	0.0	1.0	0.0
" silt loams	24 2	1.0	21.4	2.8
" silty clay loams	6.0	0.3	6.0	0.0
" stony loams	2.1	0.1	2.1	0.0
Laurel series				
Laurel loams	60.1	2.6	60.1	0.0
" loams—alkali phase	18.1	0.8	18.1	0.0
" clay loams	27.3	1.2	27.3	0.0

TABLE 3.—(Continued)—AREA IN SQUARE MILES AND PROPORTIONATE EXTENT OF EACH SOIL TYPE IN TETON COUNTY WITH TOPOGRAPHY

Soil series and types	Total area	Percentage of county	Topography: Level to sharply rolling	Topography: Sharply rolling
	sq. mi.	p. ct.	sq. mi.	p. ct.
Lismas series				
Lismas clay loams	1.9	0.0	0.0	1.9
Lowry series				
Lowry gravelly loams—slope phase	84.7	3.6	56.8	27.7
" gravelly loams—dark phase	27.1	1.2	25.9	1.2
" gravelly loams—shallow phase	39.5	1.7	39.5	0.0
" gravelly silt loams	40.6	1.7	40.6	0.0
Marias series				
Marias clay loams	12.8	0.5	12.8	0.0
Morton series				
Morton loams	14.5	0.6	14.5	0.0
" sandy loams	6.4	0.3	6.4	0.0
" silt loams	5.8	0.2	5.8	0.0
Orman series				
Orman clay loams	7.8	0.3	7.8	0.0
" clay loams—shallow phase	4.5	0.2	4.5	0.0
Pierre series				
Pierre clay loams	33.0	1.4	24.2	8.8
Power series				
Power clay loams	1.0	0.0	1.0	0.0
Phillips series				
Phillips loams	1.0	0.0	1.0	0.0
Scobey series				
Scobey loams	90.2	3.9	86.6	3.6
" sandy loams	3.8	0.1	3.8	0.0
" silt loams—dark phase	117.9	5.1	113.9	4.0
" silt loams—gravelly phase	10.3	0.4	10.3	0.0
" silty clay loams	60.4	2.4	58.4	2.0
" clay loams	9.0	0.6	9.0	0.0
" clay loams—dark phase	30.2	1.3	29.3	0.9
" stony loams	59.0	2.5	46.8	12.2
Teton series				
Teton loams	9.0	0.6	9.0	0.0
Physiographic features				
Badlands	12.7	0.5	0.0	12.7
Badland basins	7.4	0.3	7.4	0.0
Moraines—outwash gravel deposits	49.3	2.2	0.0	49.3
Mountains	453.3	19.7	0.0	453.3
Rock outcrops	15.3	0.6	0.0	15.3
Swamps	6.0	0.3	6.0	0.0

somewhat more compact, slightly heavier in texture, and lighter in color. The gray to grayish- brown carbonate zone, below 8 to 12 inches, is a compact structureless silt to silty clay loam, grading into calcareous slightly altered drift at 30 to 36 inches. A few boulders and varying amounts of gravel occur in all sections. The soils of the shallow lake basins and depressions grade locally into the Joplin silt loams.

The Joplin loams north of Lake Creek have developed over drift which forms a rather shallow covering over the area. The surface soils contain a fair amount of gravel and the subsoils often are modified by heavy residual material, derived from the underlying dark-colored shales. These shales outcrop locally along drainage courses on the southern slopes of the Teton ridge.

Topography and Tillable Area.—The Joplin loams north of Collins have an undulating topography over which are distributed low gravelly hummocks. The land along Muddy Creek is quite rolling and hummocky and on the lower slopes of the Teton ridge it is gently rolling. Drainage has not developed on the larger tracts north of Teton River. Joplin loams, classified as farming-grazing land and grazing-forage land on the land classification map, cover 53.9 square miles, about half of which is too hummocky for farming.

Utilization.—The agricultural phases of the Joplin loams were placed under cultivation at the time of the breaking out of the prairies in the eastern part of the county between 1909 and 1915. Several years of drought reduced greatly the cropped acreage after the settlement of the area and caused some land abandonment. At the time of the survey, about 20 per cent of the area, confined largely to the tracts and slopes of the Teton ridge, was under cultivation. Exclusive grain growing is the most important type of agriculture in the area. Stock raising is combined locally with grain growing on the more hummocky phases, such as north of Teton River. The land under cultivation is devoted largely to the production of spring wheat with flax grown on a fair acreage in some years. Other small grains such as oats and barley, are produced chiefly for winter feed and forage. The climate is too cool to successfully mature corn, except some of the early flint varieties. The yields of the tame grasses and legumes are low under dry-land conditions and only a small acreage is devoted to these crops. Power machinery is used on the large grain farms, covering one to three sections of land. Duckfoot cultivators and one way disks are employed in preparing the land for summer fallowing and for controlling weeds and retarding soil drifting. Small grains are grown usually on land summer fallowed every second or third year. The large grain fields are harvested with small combines, which have largely replaced headers and push binders in the area. Exclusive grain growing probably

is not as dependable as a combination of grain growing and stock raising on the Joplin loams, but such factors as available grazing land and the location of water holes influence the type of agriculture in the area.

The Joplin loams have a fair water holding capacity and are productive soils in seasons of favorable rainfall. The amount[1] of nitrogen in the surface acre-foot ranges from 4,500 to 6,000 pounds and phosphorus from 1,800 to 2,700 pounds. The soils are well supplied with lime. The yields of small grains have been quite variable, depending upon the amount and distribution of the seasonal rainfall. The average yields of spring wheat on summer-fallowed land are between 12 and 15 bushels per acre, with occasional yields of 25 bushels or more in favorable seasons.

Vegetation[2].—Grama Grass (*Bouteloua gracilis*) and is associated species form the chief cover on the Joplin loams. The black-rooted sedge known as "nigger wool" (*Carex filifolia*) and slender wheatgrass (*Agropyron tenerum*) are associated with grama grass on the more droughty phases. Other grasses such as needle grass (*Stipa comata*) and June grass (*Koeleria cristata*) are more or less prevalent, especially in the over grazed sections. Western wheatgrass (*Agropyron Smithii*) creeps in on the heavier types. The tall grasses such as needle grass and slender wheatgrass become rather coarse upon maturity and are not as palatable as the short grasses.

Mountain sage (*Artemisia frigida*) is abundant on the Joplin loams and prickly pear has a wide distribution. Gumweed (*Grindelia squarrosa*) and other shrubs are found on the loams, but have no economic value as forage plants.

The density of the grass cover increases slightly to the west on the divide north of Teton River and also on the higher and more gentle slopes of the Teton ridge. The loams have a livestock carrying capacity of 25 to 30 acres per steer for a 10-month grazing season. Mountain sage is a fair range forage for sheep

[1]Soil analysis made by Chemistry Department Montana Agricultural Exp[illegible]

[2]The vegetation is discussed from the standpont of the economic value of the different species in their relationship to the livestock carrying capacity of the different soil types. The abundance and character of the vegetation is influenced by such adversities as drought, over grazing, etc. The prevalence, of such grasses and shrubs as needle grass, June grass, and mountain sage indicate adverse climatic conditions or poor range management. The carrying capacity of the range for any particular season therefore depends upon a number of factors. The acreage given for running a steer through a grazing season (ten months) on the different soil types is an estimate made by experienced stockmen in the area. In determining the carrying capacity for sheep, four to six ewes and their lambs are considered in the equivalent of 1 steer.

and in some over-grazed sections the forage is more palatable to sheep than cattle. The larger streams have a perennial flow, but many of the small upland streams are dry during the summer months and in the more poorly watered sections storage reservoirs should be constructed.

JOPLIN SANDY LOAMS

The Joplin sandy loams, covering one square mile west of Collins, are characterized by fine sandy surface mulches, by friable grayish-brown humus bearing layers, and by well developed gray carbonate zones below 10 to 12 inches. The lower soil depths below 36 inches consist chiefly of yellowish-brown fine sandy drift. A small amount of gravel is found in all sections. The tract is all under cultivation and devoted to the production of spring wheat. The average yield of spring wheat on these sandy loams, occasionally summer fallowed to control weeds, is less than 10 bushels per acre.

JOPLIN SILT LOAMS

The Joplin silt loams have loose granular silty surface mulches and grayish-brown silty humus bearing layers with fair columnar structures. The carbonate zone below 8 inches is a compact silt to silty clay loam, streaked and blotched with lime. The parent drift below 20 to 30 inches is a grayish-brown silty clay, effervescing with acid. The soils contain a fair amount of gravel, and fragments of shale are often found in the subsoils. Locally, boulders are quite numerous on the surface.

Topography and Vegetation.—The silt loams, classified as grazing forage land on the land classification map, cover 24.2 square miles of gently rolling land on the low hummocky divide north of Teton river. These loams are quite gravelly, stony and hummocky for farming and at the time of the survey the land was used chiefly for the grazing of livestock. The soils of the isolated tracts under cultivation contain from 4,200 to 4,500 pounds of nitrogen and from 2,300 to 2,800 pounds of phosphorus in the surface acre-foot. The average yields of small grains on the silt loams are somewhat lower than on the loams. Grama grass and western wheatgrass predominate on the tracts and prickly pear is conspicuous in the overgrazed sections. The forage on 30 acres of native sod would be sufficient to support a steer for a normal 10 month grazing season.

JOPLIN SILTY CLAY LOAMS

The Joplin silty clay loams have loose fine-grained silty clay surface mulches, which often have a darker color and a distinct platy structure in the lower part. The humus bearing layers are cloddy blocky-structured grayish-brown silty clay loams, effer-

vescing freely with acid at 4 to 8 inches below the surface. The compact silty clay carbonate zone is mottled and streaked with lime and alkali and at 15 to 20 inches grades into structureless grayish-brown silty clays, flecked with lime and alkali. The lower depths are grayish olive-brown silty clays and clays effervescing with acid. A small amount of gravel is found in all sections.

Topography and Vegetation.—The silty clay loams, covering 6.0 square miles and classified as grazing forage land on the land classification map, occur chiefly in poorly drained basins on a morainic divide north of Teton River. These heavy loams are too refractory for dry-land farming and are used for the grazing of livestock. The amount of nitrogen and phosphorus in the surface acre-foot compares favorably with that found in the Joplin silt loams. Western wheatgrass forms the chief cover in the basins and the forage on 25 acres would carry a steer through a 10-month grazing season.

JOPLIN STONY LOAMS

The Joplin stony loams have profiles similar to those of the Joplin loams. The surface soils on the tops of the stony mounds and ridges are shallow. Boulders are abundant on the surface of the land and the low mounds are very gravelly. These stony loams, classified as grazing forage land on the land classification map, cover 2.1 square miles on the hummocky divide north of Teton River. The land is too stony and hummocky for farming and is used for the grazing of livestock. Grama grass and its associated species form the chief cover on the stony tracts. The forage on 25 to 30 acres would support a steer for a 10-month grazing season.

SCOBEY LOAMS

The characteristic regional fine sandy mulch occurs on the surface of the Scobey loams. The humus-bearing layers underlain with shallow heavier-textured subsurface layers are dark grayish-brown crumbly columnar-structured loams, 5 to 7 inches thick. The gray carbonate zone below 10 to 15 inches is a compact silt to silty clay loam, locally flecked and streaked with white limey material. Slightly altered grayish-brown drift occurs below 30 to 40 inches. Boulders are distributed over the surface and varying amounts of gravel are found in all sections.

The Scobey loams on the northern slopes of the Teton ridge southwest of Dutton are underlain with yellowist brown-colored fine sands and silts at 30 inches or more. Locally shales outcrop on the slopes of the ridge and the wash from them modifies the character of the soils along some of the drainage courses. The tracts east of Burton Bench and also on the slopes of the Teton

ridge are quite gravelly and stony in places.

Topography and Tillable Area.—Scobey loams cover the rolling northern slope of the Teton ridge and a large morainic area east of Burton Bench. The land east of the bench has a rolling topography characterized by numerous low mounds, ridges, and shallow lake depressions. These loams, classified as farming-grazing land on the land classification map, cover 90.2 square miles of which 3.6 square miles are sharply rolling.

Utilization.—The less stony and hummocky phases of the Scobey loams are among the more productive spring wheat soils in the county. The morainic area east of Burton Bench is too hummocky for large power machinery and in this area stock raising is combined with small-grain growing. In 1928, the cropped acreage, amounting to about 35 per cent of the total area, was confined chiefly to the northern slopes of the Teton ridge. Spring wheat grown on summer-fallowed land is the chief cash crop with flax and fall wheat of secondary importance. Other small grains and forage crops are grown on a small acreage. The cropping and tillage methods do not differ greatly from those on the Joplin loams. The Scobey loams have a good water holding capacity and under proper management are retentive of the seasonal rainfall. The surface acre-foot contains 4,100 to 6,500 pounds of nitrogen and 2,100 to 2,800 pounds of phosphorus. The average yield of spring wheat on summer-fallowed land is between 15 and 20 bushels per acre with occasional yields of 30 to 35 bushels per acre in favorable seasons. Clean summer-fallowed land on the slopes of the Teton ridge is likely to drift unless the surface is protected. Yields of spring wheat have declined slightly on the older cropped lands, where wind and water erosion has removed a portion of the surface soil.

Vegetation.—Grama grass and its associated species form the chief cover on the Scobey loams. The forage on 20 to 25 acres of native sod land would support a steer through a 10-month grazing season.

SCOBEY SANDY LOAMS

The Scobey sandy loams southeast of Choteau have somewhat lighter-colored and less pronounced columnar-structured humus bearing layers than the Scobey loams. The compact gray carbonate zone lies 10 to 15 inches below the surface and grades into grayish-brown sandy drift at 30 to 40 inches. A small amount of gravel is found in all sections. Other tracts, shown on the soil map as Scobey sandy loams, are chiefly coarse sandy loams with carbonate zones below 15 to 20 inches.

Topography and Vegetation.—Scobey sandy loams southeast of Choteau cover a portion of the upper Teton basin. The more level phases of this type are under irrigation in the basin. The

land has become seeped and is in need of drainage above the river. Other tracts, covered with these soils, have a more rolling and hummocky topography. These sandy loams cover 3.8 square miles and are classified as farming-grazing land on the land classification map. The irrigated lands are devoted chiefly to the production of forage crops such as alfalfa and the wild grasses. The coarse sandy loams above the ditch are too droughty for dryland farming and are used for the grazing of livestock. Grama grass and nigger wool predominate on the tracts and the forage on 25 to 30 acres of native sod land would support a steer through a 10-month grazing season.

SCOBEY SILT LOAMS—DARK PHASE

The dark phase of the Scobey silt loams has grayish-brown fine-grained silty surface mulches, the lower part of which often has a dark color and a platy structure. The dark grayish-brown granular humus bearing layer is 7 to 10 inches thick and overlies a slightly heavier-textured subsurface layer having a poorly defined columnar structure. The structureless grayish-brown carbonate zone below 12 to 16 inches is a silty clay loam, grading into olive-brown silts and silty clays, streaked and blotched with lime at 24 to 30 inches. Fragments of sandstone and shale often are found in the lower soil depths below 40 inches. An alkali zone, chiefly consisting of fine crystals of gypsum, is found occasionally in the lower depths of the more level and poorly drained phases. A few boulders occur on the surface and a small amount of gravel is found in all sections.

The Scobey silt loams on the tract north of Teton River in T. 25 N., R. 3 W., have somewhat more shallow horizons. The lime flecked carbonate zone lies within 6 to 8 inches of the surface and the olive-brown silts and silty clays, streaked and blotched with lime, lie below 15 to 20 inches. The lower depths below 30 to 40 inches are olive-brown silts and silty clays, effervescing with acid. Boulders are not conspicuous and the gravel content is small.

The soils on the slopes of the Teton basin often are underlain at various depths with yellowish-brown fine sands and silts probably derived from the preglacial erosion of the Teton ridge. The soils in the drainage courses are modified locally with wash from the shales exposed on the slopes of the ridge.

Topography and Tillable Area.—The dark phase of the Scobey silt loams occurs in an undulating basin north of the Teton ridge in the eastern part of the county and in other basins in the north-central part. The slopes of the undulating basin have good surface drainage, but the lower levels often have deficient drainage. Glacial mounds and lake basins are not conspicuous except in a few localities east of Dutton. These loams, classified as farming-grazing land and grazing-forage land on the land classification map,

cover 117.9 square miles of which 4.0 square miles are broken with deep coulees near the county line.

Utilization.—The dark phase of the Scobey silt loams is one of the most productive small-grain soils in Teton County. In 1928 the cropped acreage, amounting to about 65 per cent of the total area, was well distributed but somewhat concentrated around Dutton and on the slopes of the basin west of this town. Spring wheat is the most important crop with other small grains and forage crops grown on a small acreage. This crop is grown usually on summer-fallowed land, with an occasional crop of fall wheat stubbled in, in seasons of favorable fall moisture. The topography of the basin is favorable for the use of large types of farm machinery which are in general use on the large grain farms. The cultural and tillage methods are the same as on other soils in the area. The soils have a high water holding capacity and in normal seasons are not difficult to maintain in good tilth. The surface acre-foot contains 4,500 to 6,500 pounds of nitrogen and 2,100 to 2,800 pounds of phosphorus. The average yield of spring wheat on summer-fallowed land is over 20 bushels per acre with occasional yields of 35 bushels or more in favorable seasons. Summer-fallowed land has drifted in the older cropped sections the past few years and some gullying has occurred on the steeper slopes.

Vegetation.—Western wheatgrass and grama grass form the chief cover on the dark phase of the Scobey silt loams. The forage on 15 to 20 acres of native sod land would have carried a steer for a 10-month grazing season before the land was broken out.

SCOBEY SILT LOAMS—GRAVELLY PHASE

The gravelly phase of the Scobey silt loams north of Teton River in T. 24 N., R. 4 W., has a similar soil development as in the basin north of Teton River in T. 25 N., R. 3 W. This phase has been modified with wash from the gravel-capped hills to the west and is underlain at various depths with dark-colored heavy residual material derived from the underlying Colorado shales. The surface soils in the western part of the tract contain a fair amount of wash gravel, and along the drainage courses the soils grade locally into the Marias clay loams where shales outcrop.

Topography and Vegetation.—The gravelly phase of the Scobey silt loams in Range 4 West covers a rolling tract, locally broken with shallow drainage courses. These silt loams, classified as farming-grazing land, cover 10.3 square miles. Most of the tract was under cultivation at the time of the survey in 1928. The fertility of the gravelly phase, as measured by crop yields, is somewhat lower than for the dark phase. Good small grain yields can be expected from this phase where the soils are not modified greatly by gravelly wash and by heavy residual material. Western

wheatgrass predominates and the forage on 20 acres would carry a steer through a 10-month grazing season.

SCOBEY SILTY CLAY LOAMS

The Scobey silty clay loams in the Teton basin have fine-grained, silty clay surface mulches, underlain with shallow dark-colored platy-structured layers. The dark grayish-brown cloddy humus bearing layer is a silty clay loam, effervescing with acid. The olive-brown silty clays and clays below 12 to 15 inches are streaked and blotched with lime and at 36 to 40 inches or more have alkali zones, consisting chiefly of gypsum crystals. Occasionally boulders are found on the surface and a small amount of gravel occurs in all sections. These silty clay loams have developed over a glacial lake and stream deposit, which is 20 to 40 feet thick and overlies dark-colored shales in the Teton basin.

Topography and Vegetation.—Scobey silty clay loams cover the lower part of the Teton basin in the eastern part of the county and other isolated basins in the drift-covered uplands. The basin has an undulating gentle slope towards Teton River and has fair surface drainage, except for a few shallow lake depressions. Many of the upland basins are without an outlet and are in need of drainage. The border of the basin is indented with short deep coulees within 1 to 2 miles of Teton River. These heavy loams, classified, as grazing-forage land on the land classification map, cover 60.4 square miles. The soils are rather refractory for dry-land farming but in 1928 forty per cent of the area was in crops and in summer-fallowed land. Spring wheat is grown almost exclusively on these heavy loams. Disk plows are used largely in preparing the fields for a season's summer fallow, because of the plastic and tenacious nature of the soils. The surface acre-foot contains 4,500 to 5,500 pounds of nitrogen and 2,400 to 2,800 pounds of phosphorus. The yields of spring wheat on summer-fallowed land have varied greatly on these heavy loams, depending upon the amount and distribution of the seasonal rainfall. The yields average much lower than on the silt loams. The land in native sod has a good cover of Western wheatgrass and the forage on 20 to 25 acres would support a steer for a 10-month grazing season.

SCOBEY CLAY LOAMS

The Scobey clay loams cover a poorly drained basin above Teton River in Range 3 West. The profile of the clay loams does not differ greatly from the silty clay loams. The surface soils have a distinct gray cast, because of poor drainage and the strafified lower soil depths are chiefly olive-brown silts, silty clays and clays. An alkali zone, consisting largely of fine gypsum crystals, occurs at 54 inches or more.

Topography and Vegetation.—The Scobey clay loams, classi-

fied as grazing-forage land on the land classification map, cover 9.0 square miles. The soils are too heavy and too poorly drained over the greater part of the basin for farming and the land is used largely for the grazing of livestock. The better drained phases about the borders of the basin are locally under cultivation and are devoted largely to the production of spring wheat. The land has a fair cover of western wheatgrass and a livestock carrying capacity of 20 to 25 acres per steer for a 10-month grazing season.

SCOBEY CLAY LOAMS—DARK PHASE

The dark phase of the Scobey clay loams have dark grayish-brown granular humus bearing layers. The carbonate zone lies below 8 to 10 inches and grades into grayish olive-brown clays with depth. The glacial lake deposit over which these soils have developed is 70 to 80 feet thick in places.

Topography and Vegetation.—The dark phase of the Scobey clay loams, classified as farming-grazing land on the land classification map, cover 30.2 square miles of undulating land dissected with a few deep coulees east of Burton Bench. The tract is under cultivation and is considered as one of the better spring wheat producing sections in the county. The soils are heavy and are usually summer fallowed a season to mellow and pulverize the clods. The plastic and tenacious nature of the soils when moist requires the use of disk plows in preparing the land for summer fallow. The average yields of spring wheat on summer-fallowed land are between 18 and 22 bushels per acre. Western wheatgrass forms the chief cover on these heavy loams and the forage on 20 acres would carry a steer through a normal 10-month grazing season.

SCOBEY STONY LOAMS

The Scobey stony loams in the eastern part of the county have about the same profile as the Scobey loams. The stony loams, developed over mountain drift in the southwestern part of the county, have rather dark colored surface mulches and shallow dark grayish-brown humus bearing layers. The depth of the gray carbonate zone varies from 4 inches on tops of the mounds and ridges to 12 inches or more in the pot holes and basins. The subsoils are very gravelly and often are underlain with loose stratified sands and gravels. The boulders and gravel consist chiefly of limestone.

Topography, Vegetation.—The Scobey stony loams cover isolated stony tracts in the eastern part of the county and a morainic area in the southwestern part. Fresh water lakes and poorly drained sags and depressions are quite numerous in the morainic

area. The stony loams, classified as nontillable-grazing land on the land classification map, cover 59.0 square miles of which 12.2 square miles are high stony mounds and ridges. The land is too stony and hummocky for farming and is used for the grazing of livestock. Grama grass forms the chief cover on the isolated tracts in the eastern part of the county and the bunch grasses in the morainic area. The livestock carrying capacity of the stony loams varies with the different tracts, but on an average, the forage on 25 to 30 acres would carry a steer through a 10-month grazing season.

CUT BANK SANDY LOAMS[3]

The Cut Bank sandy loams have shallow sandy mulches on the surface. The texture of the grayish-brown humus bearing layer ranges from fine sandy to coarse sandy loams, with slightly developed columnar structures. The compact gray sandy carbonate zone below 5 to 8 inches grades into structureless yellowish-brown sands with depth.

Topography and Vegetation.—The Cut Bank sandy loams lie below sandstone escarpments on the slopes of a basin west of Greenfields Bench. These loams, classified as farming-grazing land on the land classification map, cover 4.4 square miles, all of which has fair surface and subsurface drainage. The land is under irrigation and in 1928 nearly all of it was under cultivation. The surface acre-foot contains 3,000 to 4,000 pounds of nitrogen and 2,100 to 2,800 pounds of phosphorus. These sandy loams have a wide crop adaptation under irrigation. The soils are somewhat low in organic matter and for the maintenance of high average yields crop rotation should be followed, barnyard manure applied, and possibly for such crops as sugar beets, phosphatic fertilizers also may be required. The land above the ditch has a good grass cover and a livestock carrying capacity of 25 to 30 acres per steer for a 10-month grazing season.

CUT BANK SILT LOAMS

The Cut Bank silt loams have fine-grained silty surface mulches and shallow grayish-brown very fine sandy to silty humus bearing layers, effervescing with acid at 6 to 8 inches below the surface. The grayish olive-brown silts below 12 inches are streaked with lime and alkali and at 42 inches grade into stratified silts and sands often containing crystals of gypsum. The lower depths below 60 to 66 inches consist largely of stratified loose yellowish-colored fine sands. Locally, the soils in the poorly

[3]The soils of the Pondera series identified as a separate soil group in the detailed soil survey of the Sun River irrigation project are correlated with the Cut Bank series in the reconnoissance soil survey.

drained depressions grade into silty clay loams, and along Muddy Creek the surface soils contain a fair amount of gravel.

Topography and Vegetation.—The Cut Bank silt loams cover portions of Burton Bench along Muddy Creek in the vicinity of Agawam. The silt loams, classified as grazing forage land on the land classification map, cover 7.0 square miles of poorly drained land, used largely for the production of wild hay and for the grazing of livestock. The water table rises over the greater part of Burton Bench during the irrigation season, and most of the land becomes too wet for the production of crops other than grass crops. The better drained phases of the Cut Bank silt loams have a good grass cover of western wheatgrass and other grasses and a fair livestock carrying capacity.

BAINVILLE LOAMS

The surface soil of the Bainville loams, above the sandstone escarpment in the central part of the county, is a gray to light grayish-brown sandy loam to loam without definite structure below the shallow fine sandy surface mulch. The subsoils below 5 to 7 inches are rusty-colored sands and loams often having the stratification and structure of the parent material. Disintegrated sandstone and shales are found at depths of 3 to 5 feet. The tracts below the sandstone escarpment consist chiefly of sandy and silty wash, which has not developed a distinct soil profile in many phases. This wash often has a glazed crust on the surface and is underlain at various depths with sandstone.

The Bainville loams in the western part of the county have rather dark-colored surface mulches and shallow dark grayish-brown humus bearing layers which do not effervesce with acids. Later correlations of the soils of the area have grouped them in a shallow phase of the Morton series. Slabs and rock outcrops of red and gray sandstone occur on the surface of the tracts between Teton River and Deep Creek. Dark-colored resistant sandstone fragments are quite numerous on the undulating area above the escarpment east of Bynum Reservoir. The area north of Sun River, below the gravel-capped benches, has a shallow covering of wash gravel on the surface, which in places is of sufficient thickness to modify the character of the surface soils.

Topography and Vegetation.—The undulating and gently rolling phases of the Bainville loams are distributed largely over the western and south-central parts of the county. The sharply rolling phases, consisting of sandstone escarpments and buttes, occur chiefly in the central part and locally about the broken borders of the gravel-capped benches. The land above the escarpment west of Choteau is broken with short deep coulees and the Deep Creek divide is eroded into badlands, buttes, and ridges. These loams, classified as grazing-forage land and as nontillable-graz-

ing land on the land classification map, cover 232.5 square miles, of which 56.5 square miles are buttes, sandstone escarpments, and land broken with deep coulees. Locally, the less stony and deeper phases are under cultivation. In 1928, 7 per cent of the tillable phase, which includes some irrigated tracts south of Choteau, was in crops and summer-fallowed land. The acreage of summer-fallowed land is small as the land drifts after a few years of cropping. Spring wheat above and alfalfa below the ditch are the more important crops. The surface acre-foot contains 3,500 to 4,000 pounds of nitrogen and 2,100 to 2,400 pounds of phosphorus. The Bainville loams, with average yields of less than 10 bushels per acre on summer-fallowed land, are among the marginal agricultural soils in Teton County. Grama grass and its associated species form the chief cover on the Bainville loams. The forage on 25 to 35 acres or more would be required to support a steer through a 10 month grazing season on the less broken phases.

BAINVILLE SILTY CLAY LOAMS

The Bainville silty clay loams have crusted silty clay surface mulches, which effervesce freely with acid. The shallow light grayish-brown humus bearing layer is poorly defined and grades into compact structureless silts and silty clays with depth. The subsoils are impregnated with alkali and often have the stratification of the parent calcareous shales.

Topography and Vegetation.—The Bainville silty clay loams cover undulating basins in the western part of the county. These heavy loams, classified as nontillable-grazing land on the land classification map, cover 31.4 square miles. The soils are too poorly drained and too high in alkali for farming and are used for the grazing of livestock. Grama grass, western wheatgrass, and other grasses form a light cover on the basins. The land has a comparatively low livestock carrying capacity.

MORTON LOAMS

The surface soils of the Morton loams on the southwestern slopes of the Teton ridge are friable columnar-structured rich-brown to dark grayish-brown loams, 6 to 8 inches thick below a shallow sandy surface mulch. The well developed gray silty carbonate zone lies below 10 to 12 inches and grades into yellowish-brown fine sands and silts at 30 to 36 inches or more. These loams have occasionally a small amount of wash quartzite gravel in the surface soils.

The Morton loams, lying at a lower elevation west of Bole Bench, have somewhat lighter-colored surface soils and the carbonate zone lies a few inches closer to the surface. The subsoils, locally stratified, are deep silts and silty clays, effervescing freely

with acid. The Morton loams in the western part of the county have dark grayish-brown humus-bearing layers with carbonate zones within 6 to 10 inches of the surface. The texture of the different tracts in this part of the county varies from sandy loams to silt loams. Slabs of red and gray sandstone occur on the surface of many of the tracts.

Topography and Vegetation.—The Morton loams occur on the undulating southwestern slopes of the Teton ridge and also on gently rolling tracts in the western part of the county. The loams, classified as farming-grazing land on the slopes of the Teton ridge and as grazing-forage land and grazing land in the western part of the area, cover 14.5 square miles, most of which has a topography suitable for cultivation. The cropped acreage, amounting to over 50 per cent of the total area in 1928, was concentrated largely on the tracts southwest of the Teton ridge. Spring wheat grown on summer-fallowed land is the most important crop. The darker-colored phases of these loams, on the lower slopes of the Teton ridge, contain 6,000 to 7,000 pounds of nitrogen and 2,400 to 3,100 pounds of phosphorus in the surface acre-foot. The average yields of spring wheat on summer-fallowed land on the deeper and darker- colored phases is over 20 bushels per acre. The yields of this crop on the more shallow phases average between 10 and 15 bushels, depending upon the location. Grama grass predominates and the forage on 15 to 20 acres would carry a steer through a 10-month grazing season.

MORTON SANDY LOAMS

The Morton sandy loams on the tract west of Bole Bench have dark grayish-brown sandy humus bearing layers, overlying a lighter-colored compact sandy subsurface layer at 7 to 10 inches. The slightly heavier-textured gray carbonate zone below 12 to 15 inches grades into loose fine sands and coarse sands at 36 inches or more. The soils on the tracts southwest of Greenfields Lake are deep, coarse sands.

Topography and Vegetation.—The Morton sandy loams occur chiefly on gently rolling tracts west of Bole Bench. The loams, classified as farming-grazing land on the land classification map, cover 6.4 square miles. Fair yields of spring wheat are obtained on the heavier-textured sandy loams in seasons of normal rainfall. The cropped acreage, devoted chiefly to spring wheat, was less than 20 per cent of the total area in 1928. The surface acre-foot contains 4,000 to 5,000 pounds of nitrogen and 2,100 pounds of phosphorus. The average yields of spring wheat on land occasionally summer-fallowed to control weeds is between 8 and 12 bushels on the heavier phases. The soils drift after the root fiber has been destroyed and some land abandonment has taken place on the more sandy tracts. The land has a good grass cover, consisting

of grama grass, nigger wool, and the tall grasses adapted to droughty conditions. A few more acres would be required to carry a steer for a 10-month grazing season than on the Morton loams.

MORTON SILT LOAMS

The soils on the gently sloping tract, covering 5.8 square miles west of Bole have the texture of silt loams. The surface soils are quite dark and the carbonate zone lies within 7 to 8 inches of the surface. The subsoils are deep silt loams, streaked and blotched with lime. The amount of nitrogen and phosphorus in the surface acre-foot compares favorably with that found in the Morton loams on the southwestern slopes of the Teton ridge. The tract is under cultivation and the average yield of spring wheat on summer-fallowed land is between 18 and 22 bushels per acre. Western wheatgrass and grama grass predominate and the forage on 20 acres would have carried a steer through a 10-month grazing season before the land was broken.

TETON LOAMS

The Teton loams have shallow, very dark brown, almost black, sandy organic mulches on the surface. The humus-bearing layers are very dark grayish-brown crumbly loams, 7 to 9 inches thick, and overlie a heavier-textured dark grayish-brown subsurface layer having a distinct columnar structure. The grayish-brown carbonate zone below 15 to 20 inches is a compact silt and silty clay loam, blotched with lime in the lower part. The lower soil depths below 4 to 5 feet consist of silts and fine sands often having the structure of the parent fine grained sandstone. Outcrops of these sandstones occur on the ridges.

Topography and Vegetation.—The Teton loams in the northwestern part of the county cover 9.0 square miles in several small basins between sandstone ridges. The land lies at a rather high elevation for general farming and is used chiefly for the grazing of livestock. The surface acre-foot contains over 7,000 pounds of nitrogen and 2,400 pounds of phosphorus. The tall bunch grasses predominate in the basins, and the forage on 12 to 15 acres would carry a steer for a 10-month grazing season.

LISMAS CLAY LOAMS

The Lismas clay loams have crusted fine-grained silty clay surface mulches overlying cloddy dark olive-drab clays. Disintegrated dark-colored shales are usually found at depths of 1 to 3 feet. These clay loams, classified as nontillable-grazing land on the land classification map, cover 1.9 square miles of barren shaly breaks along Little Muddy Creek west of Power. Greasewood and

similar shrubs adapted to alkali conditions form a light cover on the tracts. The land has a very low livestoc kcarrying capacity.

PIERRE CLAY LOAMS

The Pierre clay loams have a crusted silty clay surface mulch, which effervesces weakly with acid. The cloddy, heavy-textured humus bearing layer is poorly defined and grades into dark olive-drab clays, which usually do not effervesce with acid. The subsoils below 12 to 15 inches often are flecked with alkali and usually have the platy structure of the parent shale at depths of 3 to 5 feet.

Topography and Vegetation.—The Pierre clay loams occur on rather barren tracts below the shaly breaks of such streams as Lake and Little Muddy creeks and on isolated tracts in the western part of the county. These clay loams, classified as non-tillable land on the land classification map, cover 33.0 square miles of which 8.8 square miles are broken. The soils are too heavy and refractory for dry-land farming and are used for the grazing of livestock. Black sage and western wheatgrass form a light cover on the heavy loams. The land has a low livestock carrying capacity.

MARIAS CLAY LOAMS

The Marias clay loams west of Power are characterized by deep, fine-grained grayish-brown silty clay mulches, which effervesce freely with acid. The humus bearing layers, also effervescing with acid, are dark grayish-brown cloddy clay loams, overlying deep calcareous olive-brown silty clays and clays, which have a distinct grayish cast.

The soils on the tract north of Teton River in the northeastern part of the county show a somewhat more mature development than on the tract west of Power. Locally, the soils do not effervesce with acid within the surface 4 to 6 inches and the olive-brown silty clay and clay subsoils are streaked and blotched with lime. A few boulders are found on the surface and a small amount of gravel occurs in all sections.

Topography and Vegetation.—The Marias clay loams, classified as farming-grazing land and grazing-forage land on the land classification map, cover 12.8 square miles of gently rolling and undulating land west of Power and north of Teton River in the northeastern part of the county. The soils on the tract west of Power are rather heavy for dry-land farming, but under proper management they produce fair yields in normal seasons and are well under cultivation. The clods of these high lime soils mellow during the winter months and the land is in fair physical condition for spring seeding. The more mature soils in the northeastern part of the county with less lime in the surface layers,

are somewhat heavy and refractory for dry-land farming and are used chiefly for the grazing of livestock. The surface acre-foot contains 4,500 pounds of nitrogen and 2,000 pounds of phosphorus. The yields of spring wheat on summer-fallowed land range from 15 to 18 bushels per acre on the tract west of Power to 10 to 12 bushels per acre on the large tract in the northeastern part of the county. Western wheatgrass forms the chief cover on the heavy loams, and the forage on 25 acres would carry a steer through a 10-month grazing season.

POWER CLAY LOAMS

The Power clay loams are characterized by well developed silty clay surface mulches, by dark grayish-brown granular humus bearing layers, and by grayish olive-brown carbonate zones below 15 to 20 inches. The lower depths are deep olive-brown clays. These loams cover 1 square mile in a basin along Muddy Creek, southeast of Power. The tract is all under cultivation and the yield of spring wheat on summer-fallowed land is between 18 to 22 bushels per acre.

LOWRY GRAVELLY LOAMS[4]

The Lowry gravelly loams, developed over wash on the slopes of the gravel-capped benches, are quite variable in texture and depth. The deeper soils, such as found on the slopes of Porter Bench, have shallow surface mulches, dark grayish-brown gravelly humus bearing layers and compact gravelly silty carbonate zones below 5 to 8 inches. The lower depths below 25 inches are locally stratified and range from grayish-brown silts to yellowish-brown fine sands, containing more or less gravel. Quartzite gravel and rock occur chiefly in the surface layers and become less conspicuous with depth. North of Bynum, dark-colored residual material derived from shales outcrops in the swales and underlies the wash at comparatively shallow depths. The subsoils often are dark olive-brown clays, impregnated with alkali. The soils, developed over wash on the slopes of other benches in the north-western part of the county, have darker-colored surface soils with carbonate zones a few inches deeper. The gravel content usually increases on the upper slopes of the benches. These colluvial deposits are of variable depth, but usually the range is between 0 and 10 feet.

Topography and Vegetation.—Lowry gravelly loams occur on the undulating to rolling slopes of the gravel-capped benches in the northern part of the county. These gravelly loams, classified as grazing-forage land and as grazing land on the land classification map, cover 84.7 square miles of which 27.7 square miles are too

[4]Correlated with the Morton gravelly loams.

steep for farming. The depth of soil and topography vary appreciably on the slopes of the benches and only a small acreage is under cultivation. The irrigated land on the slopes of Porter Bench is undeveloped largely because of the difficulty in controlling seepage and alkali on land underlain at comparatively shallow depths with heavy residual material. The less gravelly and deeper phases of these loams contain 4,500 to 6,000 pounds of nitrogen and 1,800 to 2,000 pounds of phosphorus. The yields of spring wheat on summer-fallowed land range between 10 and 15 bushels or more per acre depending upon depth and character of soil and location. Grama grass forms the chief cover on the slopes of the lower benches and the bunch grasses on the higher benches. The livestock carrying capacity of the gravelly loams varies from 15 to 25 acres per steer for a 10-month grazing season.

LOWRY GRAVELLY LOAMS—DARK PHASE[5]

The soils composing the dark phase of the Lowry gravelly loams have profiles similar to the Morton loams in T. 24 N., R. 3 W., except for the content of quartzite rock and gravel in the upper layers. The colluvial deposit, over which these soils have developed is 0 to 20 feet or more in depth and overlies residual material derived from shales.

Topography and Vegetation.—The dark phase of the Lowry gravelly loams occurs on the undulating southern slopes of the Teton ridge. Heavy residual material outcrops and underlies the gravelly wash at various depths along drainage courses, which are locally seeped and impregnated with alkali. The dark phase, classified as farming-grazing land on the land classification map, covers 27.1 square miles. The cropped acreage, amounting to 65 per cent of the total area, was devoted largely to the production of spring wheat, grown on summer-fallowed land. The surface acre-foot contains 4,500 to 5,000 pounds of nitrogen and 2,100 to 3,000 pounds of phosphorus. The soils are productive and spring wheat yields on summer-fallowed land average between 15 and 20 bushels per acre. Grama grass and western wheatgrass predominate and the forage on 15 to 20 acres would support a steer for a 10-month grazing season.

LOWRY GRAVELLY LOAMS—SHALLOW PHASE[6]

A shallow covering of quartzite gravel and rock occur on isolated undulating to rolling upland tracts in the western part of the county along Willow Creek and east of Ben English Buttes. The shallow phase of the Lowry gravelly loams has about the same development as the darker phase of the Bainville loams in

[5]Correlated with the Morton gravelly loams.

[6]Correlated with the Morton gravelly loams.

the western part of the county. The lower depths consist of residual material derived from sandstone and shales. The shallow phase, classified as nontillable-grazing land on the land classification map, covers 39.5 square miles. These loams are used chiefly for the grazing of livestock. In 1928 a small acreage, devoted to spring wheat was found under cultivation along Willow Creek. The average yields of spring wheat on summer-fallowed land is less than 10 bushels per acre. The land has a fair cover of grama grass and the forage on 20 to 25 acres would support a steer through a 10-month grazing season.

LOWRY GRAVELLY SILT LOAMS[6]

Lowry gravelly silt loams in the southeastern part of the county have developed over gravelly drift, consisting chiefly of wash from the gravel-capped benches and from shaly residual areas. The gravelly drift is 0 to 12 feet thick and overlies dark-colored shales. The soils developed over this material have well developed surface mulches, and dark grayish-brown gravelly humus bearing layers, with distinct gray casts. The carbonate zones below 5 to 8 inches are gravelly silt and silty clay loams, streaked and blotched with lime. The lower depths are olive-brown silty clays and clays.

Topography and Vegetation.—Lowry gravelly silt loams cover undulating tracts along Lake and Little Muddy creeks in the southeastern part of the county. The land has fair drainage, but many of the drainage courses are seeped and impregnated with alkali. These loams, classified as farming-grazing land and as grazing land on the land classification map, cover 40.6 square miles. In 1928 the improved land was found chiefly on the larger tracts, where the heavy residual material lies below 5 feet in depth. The amount of nitrogen in the surface acre-foot ranges from 4,500 to 5,500 pounds and for phosphorus from 2,800 to 3,800 pounds. The yields of spring wheat on summer-fallowed land are quite variable on the different tracts ranging between 10 and 15 bushels per acre. The yields are exceptionally high in several subirrigated sections. The land has a good cover of western wheatgrass and grama grass and the forage on 20 to 25 acres would carry a steer for a 10-month grazing season.

ASHUELOT GRAVELLY LOAMS

The surface 3 inches of the Ashuelot gravelly loams in the southern part of Burton Bench are a grayish-brown friable gravelly loam, overlying a lighter colored gravelly loam, effervescing freely with acid. Between 12 and 17 inches the gravels are semicemented and at 24 inches they give way to stratified sands and gravels, with sands predominating below 51 inches.

Blocks of cemented gravels, 2 to 3 inches thick, occur on the surface and also above the semicemented horizon. West of Koyl in the central part of the township, the subsoils below 9 inches are structureless grayish-brown loams and silt loams, containing a small amount of gravel and below 42 inches grade innto stratified loose sands and gravels. Along Muddy Creek, the semicemented layer lies below 15 to 18 inches and the lower depths consist largely of stratified gravely silts, underlain at various depths with loose sands and gravels.

Topography and Vegetation.—The Ashuelot gravelly loams, classified as grazing-forage land on the land classification map, cover 36.6 square miles on Burton Bench. The southern part of the bench, sloping gently to the east, has a few shallow drainage courses. The gravelly loams along Muddy Creek rise gently towards the stream. The surface of the bench is characterized locally by low gravelly bars. The water table rises over the greater part of Burton Bench during the irrigation season and a fair acreage becomes too wet for the production of crops other than the grass crops. These gravelly loams are too droughty for dry-land farming, but with water the better drained and deeper phases produce fair yields of small grains and forage crops. In 1928 approximately 35 per cent of the total area was under cultivation. The cropped acreage, confined largely to the irrigated sections, was well distributed over the deeper soils with fair subsurface drainage. Small grains and forage crops are grown chiefly for winter feed. The poorly drained phases are devoted to pasture and the production of wild hay. The surface acre-foot contains 4,000 to 6,000 pounds of nitrogen and 2,400 pounds of phosphorus. Grama grass predominates on the better drained phases, with such vegetation as the sedges, wire grass, etc., on the swampy phases. These gravelly loams have a fair livestock carrying capacity.

ASHUELOT GRAVELLY LOAMS—CEMENTED PHASE

The cemented phase of the Ashuelot gravelly loams is characterized by dark grayish-brown gravelly, stony surface soils and by gravelly subsurface layers, effervescing freely with acid. The semicemented to cemented gravelly zone below 9 to 12 inches varies in thickness from 3 inches on the lower benches to 18 to 24 inches on the higher. The lower depths consist largely of stony silt loams, grading into stratified loose sands and gravels at various depths. Limestone and argillite compose most of the rocks found on the surface and in the soils.

Topography and Vegetation.—The cemented phase of the Ashuelot gravelly loams, classified as nontillable land on the land classification map, covers 52.8 square miles on smooth gently sloping benches between Deep and Willow creeks in the southwestern part of the county. The benches were placed under cultivation

at the time of settlement of the dry-land areas, but the soils proved to be too droughty for dry-land farming and most of the crop land has been abandoned. The cropped acreage in 1928, amounting to less than 2 per cent of the total area, was confined largely to the eastern slopes of the benches between Deep and Willow creeks. The surface acre-foot contains 5,000 to 8,000 pounds of nitrogen and 2,200 pounds of phosphorus. The land under cultivation is devoted largely to the production of forage crops such as sweet clover. The abandoned cropped lands have been slow to grass over and have a low livestock carrying capacity. Grama grass predominates on the lower benches and the bunch grasses on the higher. The forage on 20 to 25 acres of native sod would carry a steer for a 10-month grazing season.

ASHUELOT SILT LOAMS

The Ashuelot silt loams on Burton Bench east of Farmington have dark-colored surface soils underlain with well developed carbonate zones 6 to 10 inches below the surface. The lower depths are yellowish-brown silts and sands. Cemented gravel blocks occur locally in the soils at depths of 1 to 3 feet. The surface soils on the tract north of Muddy Creek are shallow grayish-brown gravelly loams and silt loams underlain with compact gravelly silty subsoils.

Topography and Vegetation.—The Ashuelot silt loams east of Farmington cover a gently sloping tract, which has rather poor surface drainage. The silt loams on the tract north of Muddy Creek occupy a shallow basin, which has fair drainage except at the head of the basin. These silt loams, classified as grazing-forage land on the land classification map, cover 10.6 square miles. The land lies below irrigation canals and is well under cultivation. In 1928, 66 per cent of the total area was in crops of which spring wheat, oats, and barley were the most important. The poorly drained phases, occurring chiefly along drainage courses, were devoted largely to pasture and wild hay. The surface acre-foot contains 6,000 to 7,000 pounds of nitrogen and 2,200 pounds of phosphorus. The yields of small grains on the irrigated lands compare favorably with yields of these crops on other irrigated lands in the area. The land has a good livestock carrying capacity.

ASHUELOT GRAVELLY LOAMS—SWAMPY PHASE

The swampy phase of the Ashuelot gravely loams include an undifferentiated group of poorly drained soils ranging in texture from loose gravels to silty clays. Locally, the subsurface gravels are semicemented on the better drained phases. The heavy soils in the eastern part of Burton Bench have the character of permanent swamps, but along Muddy Creek the poorly drained

gravelly loams are underlain locally with stratified yellowish-brown fine sands and silts. The rise of the water table on Burton Bench during the irrigation season locally causes the lower levels to become bogs. The poorly drained sag west of Burton Bench and north of Teton River through the sandstone escarpment is underlain with loose limestone gravel at various depths. The surface material in the sag ranges from loose limestone gravels to dark-colored silty organic matter. Limestone gravels cover a poorly drained section between Blackleaf and Muddy creeks in the northwestern part of the county. The gravel deposit is quite shallow over the greater part of the area and is underlain with dark-colored residual material, derived from shales. The higher and better drained phases grade into the shallow phase of the Lowry gravelly loams.

Topography and Vegetation.—The swampy phase of the Ashuelot gravelly loams, classified as grazing-forage land on the Burton Bench and as grazing land on the tracts between Blackleaf and Muddy creeks, cover 51.2 square miles. The better drained phases between Blackleaf and Muddy creeks were placed under cultivation at the time of the settlement of the area but were later abandoned during the dry years. The tracts on Burton Bench are devoted to pasture and the production of wild hay under irrigation. The slough grass on the wet tracts between Blackleaf and Muddy creeks also are utilized for hay, with yields ranging about 1 ton to the acre. The land has a fair livestock carrying capacity.

ASHUELOT GRAVELS

Loose limestone gravels, underlain at 10 to 12 inches with semicemented gravels, cover the western part of Burton Bench south of Muddy Creek. In the central and eastern parts, wash gravel from meandering streams covers much of the surface. Poorly drained dark-colored loams and silt loams, underlain with stratified yellowish-brown fine sands, silts, and gravels, occur locally between the gravelly drainage courses. This gravelly area, classified as grazing-forage land on the land classification map, covers 23.0 square miles. The irrigated and poorly drained lands are used for pasture and for the production of wild hay. The better drained phases above the ditch have low livestock carrying capacities.

FAIRFIELD LOAMS

The Fairfield loams in the central part of Greenfields Bench have shallow sandy mulches on the surface. The humus bearing layers are friable columnar-structured dark grayish-brown loams and gravelly loams, 5 to 6 inches thick with shallow more com-

pact and gravelly subsurface layers. The carbonate zone locally cemented below 8 to 12 inches is a grayish-brown gravelly silty clay loam extending down to a depth of 3 to 4 feet. The lower depths are stratified light brown sands, silts, and gravels.

Greenfields Bench consists of several levels or slopes on which the soils vary to some extent. The surface soils on the lowest level in the north-central part of the bench are silt loams with carbonate zones 8 to 12 inches below the surface and are underlain with gravelly subsoils. The soils in the eastern and northeastern parts of this level are somewhat heavier in texture and contain a small amount of gravel in the surface 2 feet. The soils on the highest level in the southern part of the bench are stony, gravelly loams and silt loams with a few cemented gravel blocks on the surface and in the soil. The indented borders of the bench are usually very gravelly.

The surface soils on Bole Bench are somewhat darker in color and range in texture from loams to silt loams. The carbonate zone below 10 to 14 inches is a gravelly silt loam, underlain at various depths with stratified sands and gravels. The carbonate zone of the more silty phases often is concretionary. The soils on the narrow ridge extending to the southeast are very gravelly.

The surface soils on Porters Bench east of Pendroy, containing varying amounts of gravel and rock, are dark-colored loams and silt loams. The stony, gravelly carbonate zone below 12 inches is semiconsolidated and at 40 inches or more grades into stratified yellowish-brown gravelly silts and silty clays. The surface soils in the eastern part of the bench, lying at a lower level, are lighter in color, more shallow, and occasionally cemented gravel blocks are found in the soils at depths of 10 to 20 inches.

The quartzite and argillite gravel deposit on the Greenfields and Bole benches is 25 to 50 feet thick and overlies shales and sandstones. Some of the water worn rocks on the highest level of the Greenfields Bench have diameters of 6 inches or more. The rocks found on the surface in the western part of Porter Bench are angular and consist largely of argillite. The stony gravel deposit on the bench is 10 to 15 feet thick and overlies dark colored shales.

Topography and Tillable Area.—The Fairfield loams occur on smooth gently sloping benches or high tablelands in the north-central and south-central parts of the county. Gravel bars, rising a foot or more, modify locally the surface of the benches. The borders of the benches are indented with short deep coulees, and the shallow drainage courses at the head of the larger coulees often are seeped on the irrigated benches. These loams, classified as farming-grazing land on the land classification map, cover 110.0 square miles in Teton County.

Utilization.—The Fairfield loams are among the more productive dry-land and irrigated soils in the county. In 1928 the cropped

acreage, amounting to 63.5 per cent of the total area, was well distributed over the less gravelly phases. Greenfields Bench, except for a portion of the higher level, and a small acreage on Porter Bench are under irrigation. At the time of the survey, the Gibson Reservoir, insuring an adequate water supply for the Sun River project, had not been completed and spring wheat grown largely on continuously cropped land was the most important crop on the irrigated lands. The completion of the storage reservoir will provide water for late irrigation and a more diversified type of agriculture will probably develop on Greenfields Bench. The soil and climatic conditions on this bench are adapted to a fairly wide range of irrigated crops. On most of the irrigated farms, grain, hay, and livestock will be the chief enterprises, with sugar beets and trucking crops restricted to the more diversified farms on the deeper and more fertile soils. Irrigated small grains on the higher Porter Bench are occasionally damaged by early fall frosts. Grasses and legumes do well under irrigation on the higher benches and dairying and winter feeding of livestock will probably be carried on on most of the irrigated farms. Above the ditch, spring wheat grown on summer fallowed land is the most important crop. The surface acre-foot of the Greenfields and Bole benches contains 5,000 to 6,000 pounds of nitrogen and 2,100 pounds to 2,400 pounds of phosphorus. On Porter Bench the amount of nitrogen ranges from 6,000 to 9,000 pounds and the amount of phosphorus from 2,200 to 3,000 pounds. The yields of spring wheat on the Greenfields Bench are comparatively low for irrigated lands, but with water available for the late irrigation of crops, these yields under proper soil and crop management will probably be increased greatly. The yields of spring wheat on summer-fallowed land average between 18 and 22 bushels per acre on the less droughty soils above the ditch. The subsurface drainage of the more gravelly phases is excessive and in some of the irrigated districts the duty of water is comparatively low.

Vegetation.—Grama grass and western wheatgrass form the chief cover on the Fairfield loams. The stand of grass is somewhat heavier on the higher Porter Bench. The forage on 15 to 25 acres of the native range land would carry a steer for a 10-month grazing season.

FAIRFIELD LOAMS—DARK PHASE

The dark phase of the Fairfield loams, such as found in the western part of Porter Bench and also on the benches to the west, has darker colored surface mulches and deeper and darker colored humus bearing layers than the Fairfield loams. The carbonate zone lies below 17 to 20 inches and grades into lime-coated gravels and rock at 36 inches or more. Some of the tracts have more rock on the surface than is found in these surface soils.

The surface soils in the eastern part of the gravel-capped tableland west of Greenfields Bench are dark grayish-brown gravelly loams, underlain with semicemented gravelly subsoils at various depths and in the western part are dark colored stony and gravelly loams, underlain with stony, gravelly silt and silty clay subsoils. The ridges and slopes occurring on this tableland often are very stony and are underlain with loose limestone gravel and rock at comparatively shallow depths. The surface soils on the gravel-capped divide above Deep Creek are chiefly gravelly silt loams, locally underlain at 10 inches or more with concretionary silty material.

Topography and Vegetation.—The dark phase of the Fairfield loams covers gravel-capped tablelands in the western half of the county. These high benchlands, cut with deep drainage courses, have smooth surfaces and slope gently to the east. The benchlands west of Greenfields Bench lie at different levels and are eroded into long tongues or flat-topped ridges along Deep Creek. These loams, classified as grazing-forage land on the land classification map, cover 83.9 square miles. The soils are quite stony and gravelly for farming and only the deeper and less stony phases, such as found in the western part of Porter Bench and on the divide above Deep Creek, are under cultivation. The cropped acreage is devoted chiefly to spring wheat, grown on summer-fallowed land. The surface acre-foot on the benches in the northern part of the county contains 8,000 to 10,000 pounds of nitrogen and 2,100 to 3,000 pounds of phosphorus and in the southern part from 5,000 to 7,000 pounds of nitrogen and 1,800 to 2,000 pounds of phosphorus. The growing season at elevations above 4,500 feet are cool and short and small grains, such as spring wheat, often are caught by early fall frosts. In favorable seasons the yields of spring wheat on summer-fallowed land are about the same as on the Fairfield loams. The benchlands have a good stand of the tall bunch grasses and have a high live-stock carrying capacity during the 7 to 8 months the tracts are free from snow.

FAIRFIELD GRAVELLY SILT LOAMS

The surface soil of the Fairfield gravelly silt loams is a dark-colored gravelly silt loam underlain with rather porous gravelly subsoils of considerable depth. These gravelly loams, classified as grazing-forage land on the land classification map, cover 15.0 square miles in a basin known as Pleasant Valley. The land is under cultivation and is devoted to the production of spring wheat. The amount of nitrogen and phosphorus in the surface acre-foot compares favorably with that found in the Fairfield loams. The soils are somewhat droughty and the average yield of spring wheat on summer-fallowed land is between 8 and 12

bushels per acre. The slopes of the basin have a fair cover of grama grass and western wheatgrass and the forage on 20 to 25 acres would carry a steer for a 10-month grazing season.

FAIRFIELD STONY LOAMS

The surface soils of the Fairfield stony loams are dark grayish-brown stony loams and gravelly loams underlain with stony carbonate zones at 6 to 12 inches. The lower depths below 3 to 5 feet are chiefly stratified yellowish-brown sands. These stony loams, classified as grazing-forage land on the land classification map, cover 27.9 square miles on the southern slope or level of the high bench west of Greenfields Bench. This tract, known as Sun River Slope, is one of the undeveloped units of Sun River Irrigation Project. The land under irrigation is suitable for the production of forage crops and small grains. Grama grass and western wheatgrass predominate on the tract and the forage on 20 to 25 acres would carry a steer through the 9 to 10 months the area is open for grazing.

FAIRFIELD LOAMS—ROLLING PHASE

A portion of Bole Bench north of Little Muddy Creek consists of rolling hills and ridges, capped with gravel. The soils of the gravel-capped sections have the profiles of the Fairfield loams, and in the basins or depressions between the ridges the soil profiles are similar to the Lowry gravelly loams. The rolling phase, classified as farming-grazing land on the land classification map, covers 9.4 square miles. The land is under cultivation and is devoted to the production of spring wheat. The yields of spring wheat on summer- fallowed land average somewhat lower than on Bole Bench. The land has a good cover of grama grass and western wheat-grass and the forage on 20 acres would carry a steer for a 10-month grazing season.

CROFFS STONY LOAMS

The Croffs stony loams in Teton County are characterized by very dark brown, almost black, organic surface mulches. The humus bearing layers are very dark grayish-brown granular stony loams 5 to 7 inches thick and underlain with a brown stony heavier-textured subsurface layer. The grayish-brown carbonate zone below 17 to 30 inches often is concretionary. The lower soil depths are stony silt and silty clay loams.

The surface soils on the eastern slopes of Ear Mountain are very dark grayish-brown stony silty clay loams, which are underlain with stony silty clays, streaked and blotched with lime below

14 inches. The lower depths below 50 inches are olive-brown stony silty clay loams.

The high benches along Muddy Creek and its branches below the mountains have a fibrous mat of organic matter on the surface. The humus bearing layers are dark reddish-brown stony loams, underlain with reddish-brown stony silty clay subsurface layers. The stony carbonate zone lies below 14 to 20 inches and grades into stony silts and silty clays with depth.

Topography and Vegetation.—The Croffs stony loams occur on high benchlands on the eastern slopes of the mountains. The land, classified as nontillable grazing land on the land classification map, covers 56.7 square miles. The benches are too stony and lie at too high an elevation for farming and are used for the grazing of livestock. The land has a good cover of the tall bunch grasses and a high livestock carrying capacity during the 6 to 7 months the area is free from snow.

CROFFS STONY LOAMS—DARK PHASE

The dark phase of the Croffs stony loams occurs on several high benches below the mountains along the Forks of Dupuyer Creek in the northwestern part of the county. These soils, similar to those mapped in Glacier County, have black fibrous organic surface mulches and the humus bearing layers are black granular stony loams, underlain with brown stony silt to silty clay subsurface layers. A grayish-brown stony carbonate zone, grading into stony material, was found below 30 inches in the lower part of the benches. These stony loams, classified as nontillable-grazing land on the land classification map, cover 10.7 square miles. The benches have a good cover of the tall bunch grasses and a high livestock carrying capacity during the 6 to 7 months the tracts are free from snow.

BUFFALO LOAMS AND STONY LOAMS

The Buffalo loams and stony loams, occurring on eroded gravel-capped ridges and buttes in different parts of the county, have profiles similar to the Fairfield loams. The surface soils are dark grayish-brown loams and stony loams, with stony gravelly carbonate zones, which are locally concretionary below 10 to 14 inches. The lower soil depths, on such ridges as the Teton ridge, often are stratified yellowish-brown sands and silts. These loams, classified as nontillable-grazing land on the land classification map, cover 19.5 square miles. The tracts are not under cultivation except for a small acreage on the Teton ridge. Grama grass and western wheatgrass predominates on the tracts, and the forage on 20 to 25 acres would carry a steer for a 10-month grazing season.

COLE CLAY LOAMS

The surface soils of the Cole clay loams are grayish-brown silty clays and clay loams, effervescing with acid at 5 to 8 inches, and containing a small amount of quartzite gravel. The lower depths are grayish olive-brown stratified silty clays and clays, grading into dark olive-drab clays, derived from the underlying shales.

Topography and Vegetation.—The Cole clay loams occupy a basin along Muddy Creek below Fairfield Bench east of Greenfields Lake. These heavy loams, classified as grazing-forage land on the land classification map, cover 3.6 square miles. The land is under irrigation, but because of the difficulty of controlling seepage from Greenfields Bench only a small acreage is under cultivation. The clay loams have a fair cover of western wheatgrass and the forage on 25 acres would carry a steer through a 10-month grazing season.

ORMAN CLAY LOAMS

The Orman clay loams have fine-grained silty clay surface mulches and poorly-defined silty clay humus bearing layers, which often have a slight platy structure. The structureless carbonate zone below 8 to 10 inches is a grayish olive-brown clay, flecked with lime and alkali below 24 inches. The lower soil depths are dark olive-brown clays.

Topography and Vegetation.—The Orman clay loams cover a basin along Lake Creek in the southeastern part of the county. These heavy loams, classified as nontillable-grazing land on the land classification map, cover 7.8 square miles. The land is too heavy and poorly drained for farming and is used for the grazing of livestock. Western wheatgrass predominates in the basin and the forage on 25 acres would support a steer for a 10-month grazing season.

ORMAN CLAY LOAMS—SHALLOW PHASE

The shallow phase of the Orman clay loams, occurring in a gap north of Greenfields Bench, has shallow silty clay surface mulches and cloddy grayish-brown silty clay humus bearing layers, effervescing weakly with acid. The lower depths below 4 to 5 inches are stratified silty clays and clays flecked with lime and alkali. The shallow phase, classified as nontillable-grazing land on the land classification map, covers 4.5 square miles. The tract is used for the grazing of livestock. The land has a light cover of western wheatgrass and a low livestock carrying capacity.

CHEYENNE GRAVELLY LOAMS

The Cheyenne gravelly loams in the vicinity of Bynum have grayish-brown sandy surface mulches and dark grayish-brown gravelly humus bearing layers. The carbonate zone below 8 to 10 inches is very gravelly and below 20 to 30 inches grades into stratified sands, silts, and gravels. Along Teton River in the west-central part of the county loose sands and gravels occur on the terraces south of the river and deep sandy loams, underlain with sand and gravel, cover the tracts north of the stream. South of Choteau light grayish-brown loams and sandy loams, underlain at various depths with stratified sands and gravels, predominate on the low benches. Farther east along Teton River, the soils on the tracts are chiefly stratified gravelly loams and silt loams. The gravelly loams in Ranges 4, 5, and 6 West along Sun River are underlain locally with semi-consolidated limestone gravel, and in Range 3 West the soils have similar profiles to those found on the terraces south of Choteau.

Topography and Vegetation.—The Cheyenne gravelly loams, occur on low terraces and secondary benches along the larger streams in different parts of the county. These loams, classified as grazing-forage land, as grazing land, and as nontillable-grazing land on the land classification map, cover 32.9 square miles. The soils on many of the tracts are too droughty for dry-land farming and are used chiefly for the grazing of livestock. The Cheyenne gravelly loams along Muddy Creek, along Teton River south of Choteau, and along Sun River in Ranges 4, 5 and 6 West are under irrigation and are devoted chiefly to the production of alfalfa. Under irrigation the less gravelly phases also produce fair small grain crops. The water table rises during the irrigation season on some of the tracts, such as along Muddy Creek and Sun River and the land becomes locally too wet for the production of crops other than the grass crops. Grama grass forms a light cover on the tracts and the land has only a fair livestock carrying capacity.

CHEYENNE GRAVELLY LOAMS—MODIFIED PHASE

The soils on the secondary bench in T. 20 and 21 N., R. 5 W., are modified with wash from the residual area to the north. The soils over the greater part of the bench are deep silt and silty clay loams, containing a small amount of gravel. Loose limestone gravel underlies the tract at 3 to 10 feet or more. The modified phase, classified as grazing land on the land classification map, covers 5.0 square miles. The cultivated land is under irrigation and is devoted chiefly to the production of alfalfa and the wild grasses. A portion of the irrigated area is in need of drainage.

PHILLIPS LOAMS

The Phillips loams in Teton County cover dry upland lake beds and gentle slopes of streams, characterized by "blow out holes" or so-called "scab spots" in the glaciated area. The texture of the soils in the lake bottoms and on the stream slopes ranges from a silty clay to clay loam. The bare spots have a grayish-brown firm crust on the surface, below which the heavy material has a porous or vascular structure of about one inch. Below this porous layer, the dark grayish-brown silty clays and clays have a nutty structure and grade into structureless grayish-brown heavy material, effervescing with acid. The soils of the grassed-over areas between the bare spots have the profiles of the Scobey clay loams. These scabby loams, classified, as nontillable-grazing land on the land classification map, cover one square mile. The grassed-over portion of the tracts has a light cover of western wheatgrass. The land has a low livestock carrying capacity.

CHOUTEAU LOAMS

The Chouteau loams include a group of undifferentiated dark-colored soil covering the stream bottoms and lake basins along the base of the mountains. These soils range in texture from loams to stony loams and have no definite horizons, except those produced by poor drainage. The soils effervesce freely with acid where the alluvium is derived largely from limestone and calcareous sedimentary material.

Large tracts of poorly-drained dark-colored soils lie below the moraines and outwash gravels in the western part of the county. The water table rises on these tracts during the spring runoff, and the very dark grayish-brown, almost black, organic surface soils are underlain with compact dark-colored silty clays and clays which have a distinct bluish cast in the more poorly-drained sections and a grayish olive-brown color in the better drained sections. Loose limestone gravels underlie the tracts at depths of 1 to 5 feet.

Topography and Vegetation.—The Chouteau loams cover stream bottoms and swampy tracts in the western part of the county. These loams, classified as nontillable-grazing land on the land classification map, cover 64.9 square miles. The sedges and wire grasses predominate on the tracts, and the land has a high livestock carrying capacity. The wet bottoms are valuable wild hay lands.

LAUREL LOAMS

The Laurel loams, effervescing freely with acid, include a group of undifferentiated gray soils, covering the stream bottoms in the central and western parts of the county. In this group is

included the stony river wash along some of the larger streams, such as the Teton and Sun rivers. The soils are without distinct horizons and range in texture from loose sands and gravels to refractory silty clays and clays. In the vicinity of Choteau, the soils, covering the poorly drained bottom of Teton River, are loose sands, gravels, and gravelly loams. The bottom of many of the upland streams are impregnated with alkali and on the soil map, the soils of these stream bottoms are shown as an alkali phase of the Laurel loams.

Topography and Vegetation.—The Laurel loams, covering stream bottoms in the eastern and central parts of the county, are classified chiefly as grazing land on the land classification map. These loams cover 60.1 square miles of which 18.1 square miles are impregnated with alkali and so shown on the soil map. These loams are not under cultivation, except for isolated subirrigated tracts or where the higher terraces above high water levels lie below irrigation ditches. The lower levels along the larger streams support a dense growth of cotton woods, willows, and brush. Wet bottoms occur locally and the higher terraces often have a fair stand of grama grass and western wheatgrass. Sedges predominate in the sloughs and greasewood and other shrubs are found on the more alkaline phases. The livestock carrying capacity of the loams varies with the different stream bottoms, but in general, it is low.

LAUREL CLAY LOAMS

The more barren grayish-brown silty clays and clays, covering the stream and lake bottoms, which do not effervesce freely with acid, are grouped in the Laurel clay loams. These soils are cloddy stratified silty clays and clays with subsoils impregnated with alkali.

Topography and Vegetation.—The Laurel clay loams cover the greater part of the Greenfields Lake basin and also occur in other heavy basins in the county. The clay loams, classified as non-tillable-grazing land on the land classification map, cover 27.3 square miles. The land has a light vegetative cover except for the more swampy phases. Greasewood is conspicuous in the alkali impregnated areas. The land has a low livestock carrying capacity.

BADLANDS

Isolated tracts of barren, gullied clay hills and ridges, covering 12.7 square miles, occur on the southern slopes of Willow Creek Dome, along Blackleaf Creek east of Ben English Buttes, and locally, below the gravel-capped benches. The tracts are covered lightly with vegetation and have a low livestock carrying capacity.

BADLAND BASINS

Badland basins or alkali flats cover 7.4 square miles along Lake Creek in the southeastern part of the county. The surface of these tracts is a glazed silty clay with a vascular structure in the lower part. The lower depths are stratified grayish-brown compact silty clays and clays highly impregnated with alkali. The vegetation on the tracts consist chiefly of greasewood, shadscale and salt sage. The land has a low livestock carrying capacity.

MOUNTAINS

Mountains cover approximately 14½ townships in the western part of the county. This rough broken area consists largely of bald peaks, serrated ridges, talus covered clopes, inaccessible timbered areas, and open parks. The eastern slopes are not well covered with timber. Lodgepole pine occurs on the higher slopes and quaking aspen and willows in the poorly-drained canyons and gulches. Sedges predominate in the open parks and shrubs form most of the underbrush. The livestock carrying capacity of the mountainous areas is low for cattle, but fair for sheep.

MORAINES—OUTWASH GRAVELS—SWAMPS—ROCK OUTCROPS

Moraines and outwash gravel deposits cover 49.3 square miles of nontillable-grazing land. The moraines below the mouth of the Teton and Blackleaf canyons have a light stand of scrub pine and a thin cover of underbrush. The outwash gravel deposits along Teton River are lightly grassed over.

Rock outcrops, consisting chiefly of resistant sandstone, cover 15.3 square miles in the southwestern part of the county. The area is quite barren except for a few scrub pine.

Swamps, having little grazing value, cover 6.0 square miles below moraines in the western part of the county. A dense growth of willows covers the swampy tracts.

AGRICULTURE

Shortly after the establishment of the Fort Shaw Military post in 1867, cattle were driven in from the Texas plains by Ford and others and these herds probably were the first to run at large east of the mountains in Montana. Stock raising spread rapidly to other sections of central Montana and after the Indians were confined to the reservations it was the chief industry for many years. Irrigation in Teton County was developed by some of the early stockmen, who saw the need of supplementing their winter grazing lands with wild hays to prevent an occasional heavy winter loss of livestock. Small ditches were taken out along the perennial streams during the early nineties and after 1895 many

small private projects were developed. Farming above the ditch dates from the early seventies, when a small acreage was broken out and devoted to the production of small grains, vegetables, and root crops for the military post at Fort Shaw. It developed slowly until about 1909, when the so-called dry land movement began in this part of the state.

The larger stream bottoms and winter grazing lands were filed upon by the early stockmen during the late eighties and early nineties. The public range lands were settled and fenced, largely in tracts of 160 and 320 acres, between 1909 and 1915. The first unit of the Sun River Irrigation Project was opened for settlement in 40-acre tracts in 1908. Crop yields have been fair since the settlement of the dry-land areas except for a few dry years between 1917 and 1920. Most of the desirable agricultural land in Teton County is under cultivation.

The general trend of agriculture in Teton County is shown by a few statistics taken from the United States Census reports for the years 1925, 1930, and those available for 1935. In 1925, 64.6 per cent of all the farm lands in the county had a mortgage indebtedness of $10.11 on land valued at $19.27 per acre and in 1930, 54.3 per cent had an average mortgage indebtedness of $7.11 on land valued at $22.75 per acre. Farm tenancy increased between 1925 and 1935 from 21.4 to 24.4 per cent. The percentage of the total area in farms at the present time is 72.6 per cent. The number of farms has decreased slightly during the past ten years, from 1,078 to 1,072, while the average size of farms for the same period has increased from 750.0 to 995.0 acres. Land values are nominal, the better improved lands in the better farming sections are held at $20 to $30 and the less improved at $10 to $20 per acre. The irrigated lands with paid up construction charges are held at $50 to $100 per acre, depending upon location and improvements. Nontillable-grazing land is priced at $1 to $7 per acre, depending upon livestock carrying capacity, water holes, and location. The gross agricultural income for the county is derived largely from livestock and agricultural products grown on the dry and irrigated farms.

Stock Raising.—The western part of Teton County is primarily a grazing area, suitable chiefly for the production of livestock. Stock are run on the open range during the grazing season and wintered on ranches provided with wild and tame hay or moved to the irrigated districts. The slough grasses make a fair quality of hay, but for best feeding results they should be supplemented with other forage crops and commercial feeds. In the dry-land sections in the eastern part of the county the winter grazing lands often are supplemented with straw, small grain hays, and wild hays. In the irrigated section the beef breeds are run usually on the open range during the summer months and wintered on the

irrigated ranches or farms. Dairy stock is grazed on tame pastures during the summer. Teton County is well watered, although in the eastern part it is necessary to depend on storage reservoirs in some localities for stock water during the late summer and fall.

Herefords and Shorthorns are the more important beef breeds found on the range. The total number of cattle in the county has increased during the past five years from 24,918 to 38,756. The number of milk cows reported on the farms in 1930 was 2,777.

Sheep were brought into the area at a comparatively early date. The range conditions in Teton County are somewhat more favorable for the raising of cattle than sheep, and until the irrigation projects were developed their importance as a source of income was less than for cattle. In 1930, the number of sheep and lambs in the county was 112,278 and in 1935, 102,326.

The increasing use of small tractors on the dry and irrigated farms has reduced greatly the number of horses. The number of horses has decreased from 6,603 to 5,220 during the past five years. The swine industry is unimportant as only 1,688 head were found on the farms in 1935. The Duroc Jersey is the most popular breed in this part of the state.

Dry-land Farming.—The assessed, nonirrigated tillable land in 1934 was 456,203 acres. The cropped acreage, which also includes the irrigated crop lands, has averaged 321,183 since 1925, according to the United States Census reports.

The crops grown above the ditch in Teton County are the early and medium early varieties of small grains and forage crops. The more important small grains are wheat, flax, oats, barley, and rye. Fall grains, except fall rye, winter kill too frequently to be depended upon, but on some of the darker-colored and heavier-textured soils, such as the Scobey loams and silt loams, fall wheat is grown successfully in normal seasons. The climate is too cool to mature the dent and semident varieties of corn and only a small acreage of corn is grown for fodder and hogging off. Oats and barley are grown largely on the dry-land farms for winter feed and forage. Flax produces fair yields on new breaking and in some years a fair acreage is grown. Table 4 gives the acreage and yields of the more important crops grown in Teton County since 1925.

Alfalfa, sweet clover, and brome grass are the chief forage crops grown above the ditch. The yields of these grasses and legumes are low under dry-land conditions and only a small acreage is devoted to these crops. The yields of root crops, such as potatoes, average low under dry-land conditions and only a small acreage is grown for home consumption.

On the large grain farms, where 200 to 600 acres are cropped annually and a similar acreage often is summer fallowed, duck foot cultivators and one way disks drawn by small tractors are

TABLE 4.—ACREAGE AND YIELDS OF THE MORE IMPORTANT CROPS GROW

	1925*		1930*		1
	Acreage	Acre Yields (bu. or tons)	Acreage	Acre Yields (bu. or tons	Acreage
Crop land harvested	173,229	—	219,550	—	201,476
Crop land failure	12,752	—	5,675	—	7,867
Crop land idle or fallow	85,181	—	131,665	—	126,155
Crop land total	271,162	—	356,890	—	335,498
Barley	2,630	16.5	3,088	15.5	3,088
Corn—all purposes	2,748	10.1	45	0.0	352
Flax	375	5.5	4,859	5.9	3,404
Hay—wild and tame	43,081	0.8	46,513	1.0	56,991
Oats	8,832	18.9	5,455	17.6	8,600
Potatoes	275	65.2	183	70.0	524
Rye	50	8.1	—	—	—
Wheat—fall and spring	114,523	10.3	154,060	12.9	118,279
Sugar beets	00	0.0	—	0.0	34

*United States Farm Census.

used in preparing the land for summer fallow and for seeding. These implements are efficient in lowering the cost of production, in destroying weeds, and in producing a cloddy mulch on the surface. Small combines are employed in harvesting large grain fields.

Irrigation Farming.—The acreage of irrigated lands assessed in Teton County in 1934 was 13,137 acres. The small grains grown under irrigation are the medium early maturing varieties, except in the case of spring wheat. Alfalfa is the chief forage crop with sweet clover grown occasionally for pasture and in short rotations. The soil, climate, and marketing conditions in this part of the state favor the development of a type of agriculture in which grain, hay and livestock are combined on the irrigated farms. Dairying is developing in a few localities and the growing of specialized crops such as peas have possibilities. Sugar beets have been grown on the Greenfields Bench during the past few years, but the yields have averaged comparatively low. Several of the more important irrigation projects in the county lie within 30 to 60 miles of Great Falls, a city of about 30,000 inhabitants. A fair acreage probably will be devoted to trucking crops on the lighter soils.

LAND UTILIZATION PROBLEMS

One of the more important problems in Teton County is the consolidation of the original homestead tracts into economical farm and ranch units. On the larger grain farms, 2 to 3 sections or more often are handled by one operator and on the irrigated lands from 160 to 320 acres. The carrying capacity of the range for livestock would require 5 to 10 sections to run 250 to 300 head of cattle.

Dry-land Problems.—Continuous cropping to spring wheat on summer-fallowed land results in more or less soil drifting after the root fiber has been destroyed. The heavier loams often drift in the early spring after the frost leaves the ground and before the surface is crusted by spring rains. Cultural methods, such as ridging the land and leaving the stubble on the surface, are the chief means of controlling soil drifting at the present time. Seeding the land to grass and legumes is more effective in holding the soils in place and in restoring the root fiber. Strip farming also is a practical means of holding the soil in place.

The yields of small grains often vary greatly in different localities under the same cultural methods. These variations in yields are attributed usually to poor farming, to low rainfall, and to other factors. Analysis of the potential fertility of the soil of the different agricultural districts indicate that the fertility of the soils also may be a factor.

Irrigation Problems.—On the reclamation and Carey Act projects in the county, spring wheat, grown continuously on the irrigated lands, has resulted in an increasing growth of weeds and a decline in the physical condition of the soils. A rotation of small grains and legumes or grasses would be more effective in controlling weeds and maintaining higher average yields. On the lower benches sugar beets are grown and may become an important intertilled crop to complete a well-balanced rotation. The soils on the quartzite gravel-capped benches are comparatively low in phosphorus and such root crops as sugar beets have been found to respond to phosphatic fertilizers.

Drainage is important on all the projects but is more important on the smaller projects where the cost cannot be distributed over a large acreage. A large portion of Burton Bench and other irrigated tracts are too wet for farming until the land is drained. An extensive drainage system is now being developed on Greenfields Bench. Some difficulty has been experincd in handling the heavier soil types and also in irrigating the more level and depressed tracts.

AREAS UNDER IRRIGATION

Construction work on the Sun River Irrigation Project, covering a gross area of 148,700 acres, of which 104,000 acres are irrigable in Teton and Cascade counties, was started in 1906 and the first division was open for settlement in tracts of 40 acres in 1908. The Greenfields division of 64,660 acres of irrigable land is located on Greenfields Bench and approximately 40,000 acres are in cultivation under the ditch. Sun River Slope division, comprising 18,000 acres, is located on the lower level of the gravel-capped plateaus west of Greenfields Bench. Canals have been constructed but the division is undeveloped. The Big Coulee division, covering 2,300 acres and lying south of Greenfields Bench above Sun River, is partly developed. The Fairfield loams are the more important soils on the Greenfields division and the stony phase of these loams on the Sun River Slope division. The Bainville loams and Cheyenne gravelly loams cover the greater part of the Big Coulee division. The completion of the Gibson dam, creating a large storage reservoir in Sun River Canyon, and the Pishkum auxiliary reservoir insure an adqeuate water supply for the Sun River project.

Under the Carey Act, 40,000 acres were segregated in the northern part of Teton and southern part of Pondera County for the Teton project. This project was later abandoned and the Bynum irrigation district organized in 1920. The Bynum project comprises 25,000 acres of irrigable land covering the northern part of Burton Bench and a small acreage on and below Porter

Bench. Water for this project is obtained from the normal flow of Muddy and Blackleaf creeks, and also from flood waters of Teton River stored in Bynum Reservoir. This project also supplies water for about 5,000 acres, located in Pondera County around Brady. Canals have been constructed over the greater part of the project and the more desirable and better drained lands are under cultivation around Bynum. The soils under cultivation are chiefly the Ashuelot gravelly loams and silt loams and the Cheyenne gravelly loams. The Lowry gravelly loams, covering the slopes of Porter Bench are underlain at various depths with heavy residual material, and more or less difficulty will be experienced in draining this portion of the project. The Cut Bank silt and silty clay loams along Muddy Creek are quite level and when drained will prove to be productive soils.

The Burton, Farmers, and Eldorado ditches supply water to about 40,000 acres on Burton Bench. The source of water for these cooperative projects is Teton River. The Ashuelot gravels, gravelly loams, and silt loams are the more important soils. The water table rises on Burton Bench during the irrigation season and a large acreage is in need of drainage.

Deep Creek supplies water to approximately 3,000 acres located along this stream and Teton River. The soils under irrigation are largely the Bainville loams, Cheyenne gravelly loams, and Scobey sandy loams and silty clay loams. The lower levels along Teton River and also above Greenfields Lake basin are seeped and in need of drainage. Along Willow Creek, about 1,000 acres are under irrigation. In the southern part of the county, the Floweree canal diverts water from Sun River onto gravelly benches along Sun River and also onto a small upland area. The soils below the canal are chiefly the Bainville loams and Cheyenne gravelly loams. The upland acreage is not well developed, and seepage problems have developed locally on the high terraces. Small tracts of irrigated land occur along other perennial streams in the county.

FUEL AND WATER RESOURCES

The agricultural development of some sections of Montana is influenced by the water and fuel resources. Most of Teton County is supplied with an excellent quality of water for domestic use. Most of the fuel, except wood, is obtained from neighboring counties.

Colorado shales underlie the drift and glacial lake and stream deposits in the eastern half of the county. Water from these shales is usually brackish and unfit for domestic use. In the area underlain with these shales a fair quality of water is sometimes found in the deeper drift deposits, and in the more shallow drift

covered sections surface waters are caught in cisterns and small reservoirs, or hauled from the perennial streams. In the central and western parts of the county, the water table is comparatively shallow and of good quality for domestic use, except locally in the glacial lake basins and in the heavy residual sections. An excellent quality of water is found in the mountains and on the gravel-capped plateaus and lower benches.

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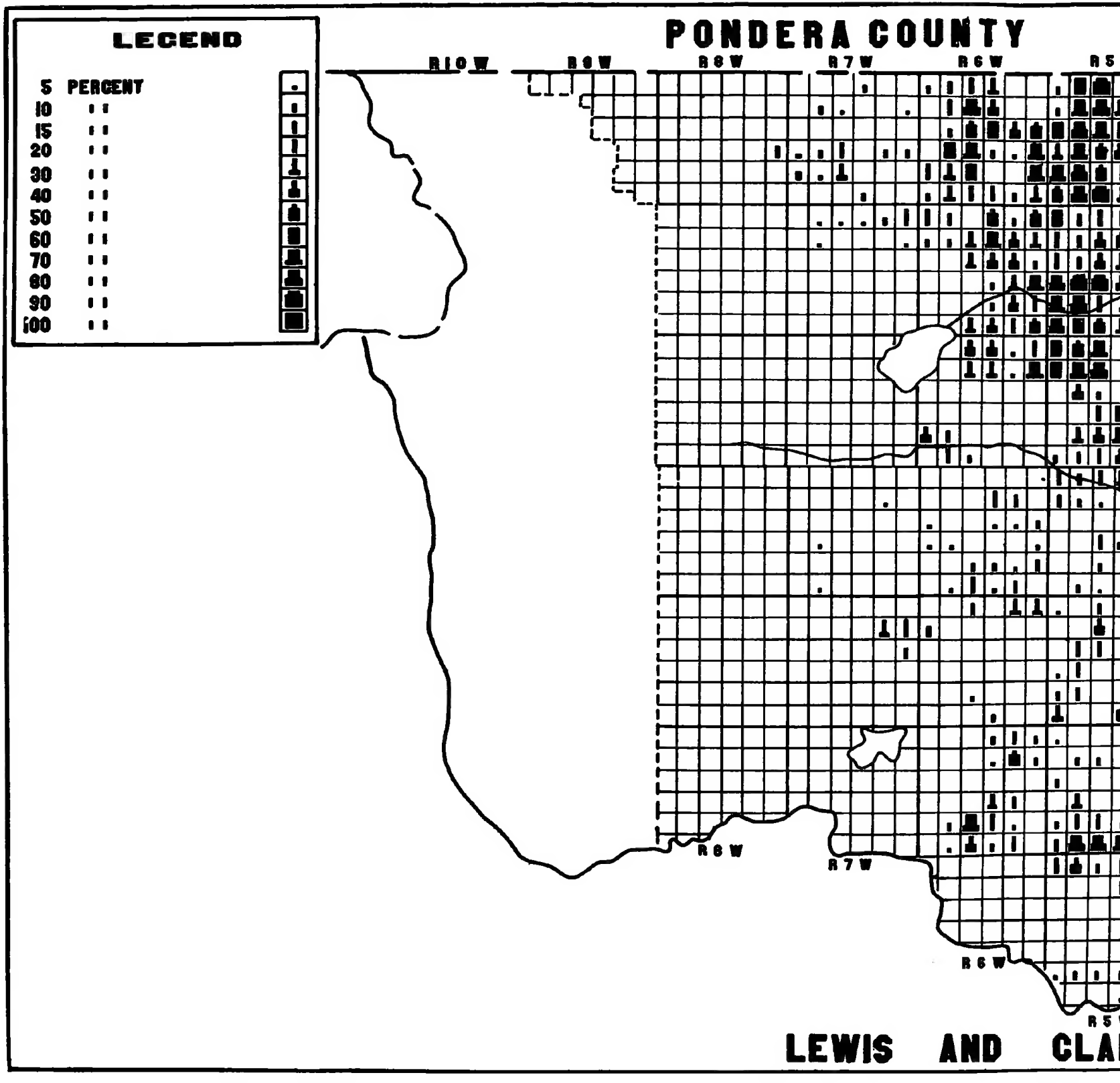
LEGEND
5 PERCENT
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PONDERA COUNTY
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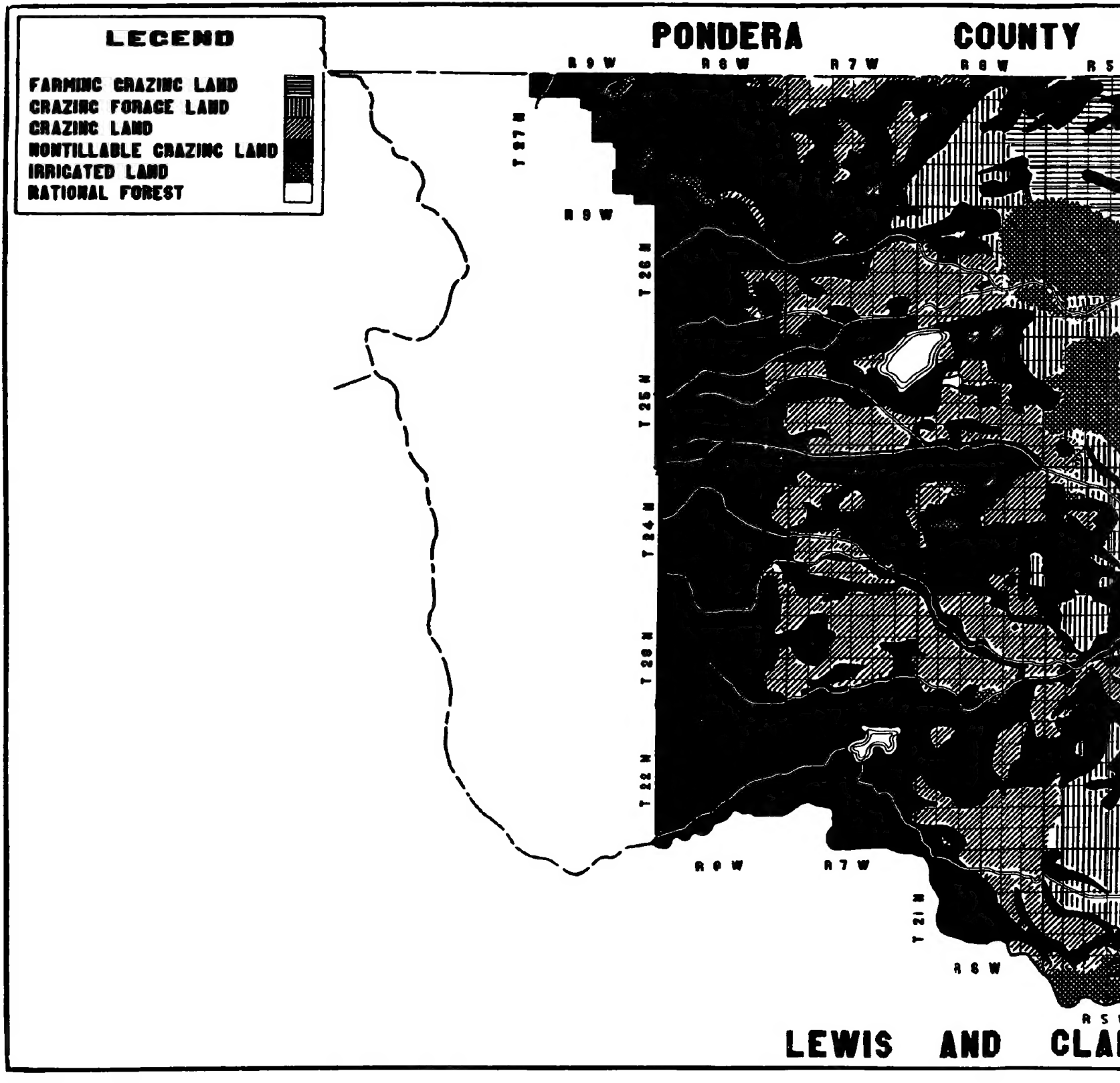
LEWIS AND CLA


LEGEND
FARMING GRAZING LAND
GRAZING FORAGE LAND
GRAZING LAND
NONTILLABLE GRAZING LAND
IRRIGATED LAND
NATIONAL FOREST
PONDERA COUNTY
R9W
R8W
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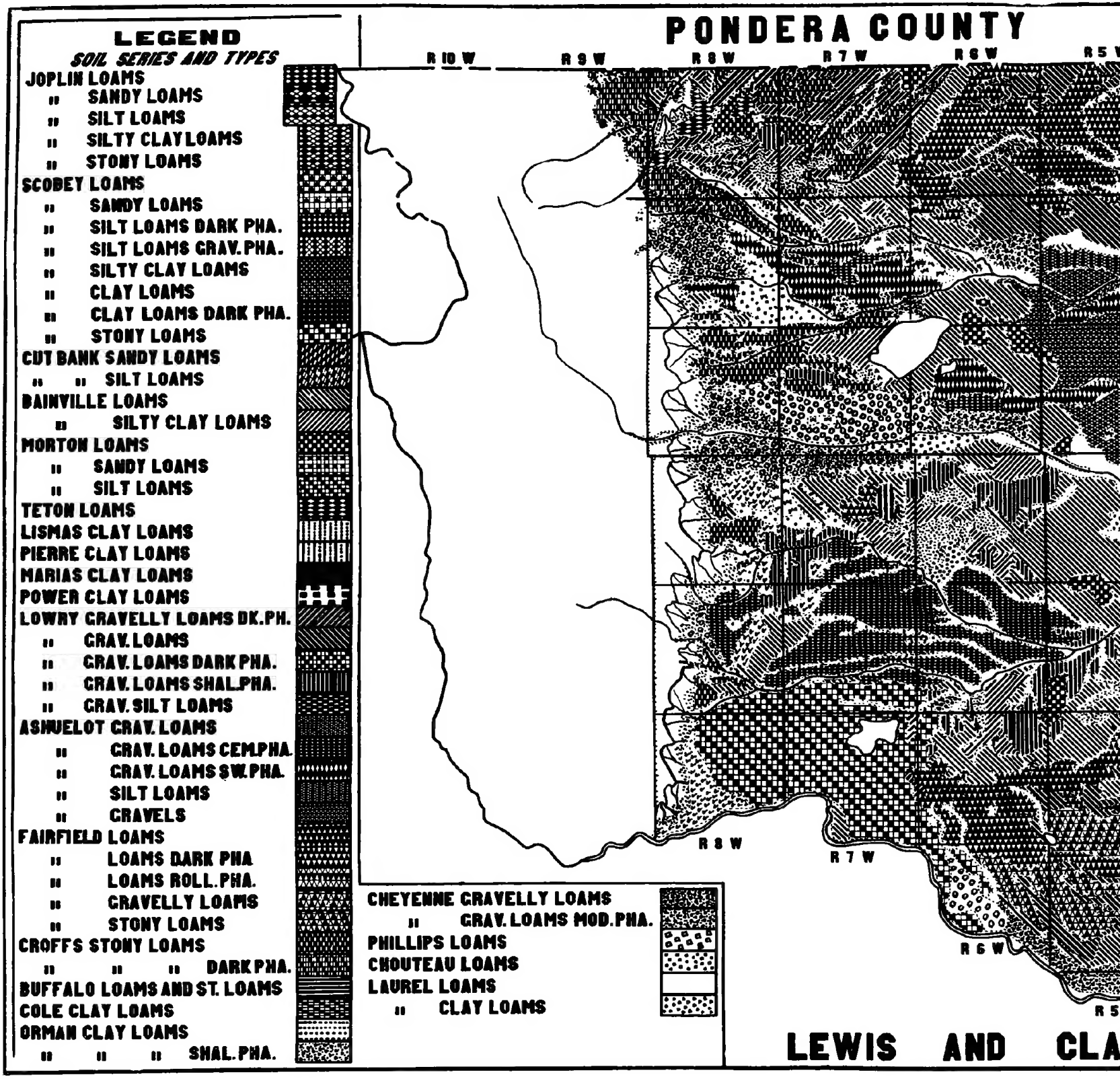
R6W
T27N
T26N
T25N
T24N
T23N
T22N
T21N
LEWIS AND CLA


LEGEND
SOIL SERIES AND TYPES
JOPLIN LOAMS
" SANDY LOAMS
" SILT LOAMS
" SILTY CLAY LOAMS
" STONY LOAMS
SCOBEY LOAMS
" SANDY LOAMS
" SILT LOAMS DARK PHA.
" SILT LOAMS GRAV. PHA.
" SILTY CLAY LOAMS
" CLAY LOAMS
" CLAY LOAMS DARK PHA.
" STONY LOAMS
CUT BANK SANDY LOAMS
" " SILT LOAMS
BAINVILLE LOAMS
" SILTY CLAY LOAMS
MORTON LOAMS
" SANDY LOAMS
" SILT LOAMS
TETON LOAMS
LISMAS CLAY LOAMS
PIERRE CLAY LOAMS
MARIAS CLAY LOAMS
POWER CLAY LOAMS
LOWRY GRAVELLY LOAMS DK. PH.
" GRAV. LOAMS
" GRAV. LOAMS DARK PHA.
" GRAV. LOAMS SHAL. PHA.
" GRAV. SILT LOAMS
ASHUELOT GRAV. LOAMS
" GRAV. LOAMS CEM. PHA.
" GRAV. LOAMS SW. PHA.
" SILT LOAMS
" GRAVELS
FAIRFIELD LOAMS
" LOAMS DARK PHA
" LOAMS ROLL. PHA.
" GRAVELLY LOAMS
" STONY LOAMS
CROFFS STONY LOAMS
" " " DARK PHA.
BUFFALO LOAMS AND ST. LOAMS
COLE CLAY LOAMS
ORMAN CLAY LOAMS
" " " SHAL. PHA.
CHEYENNE GRAVELLY LOAMS
" GRAV. LOAMS MOD. PHA.
PHILLIPS LOAMS
CHOUTEAU LOAMS
LAUREL LOAMS
" CLAY LOAMS
PONDERA COUNTY
R 10 W
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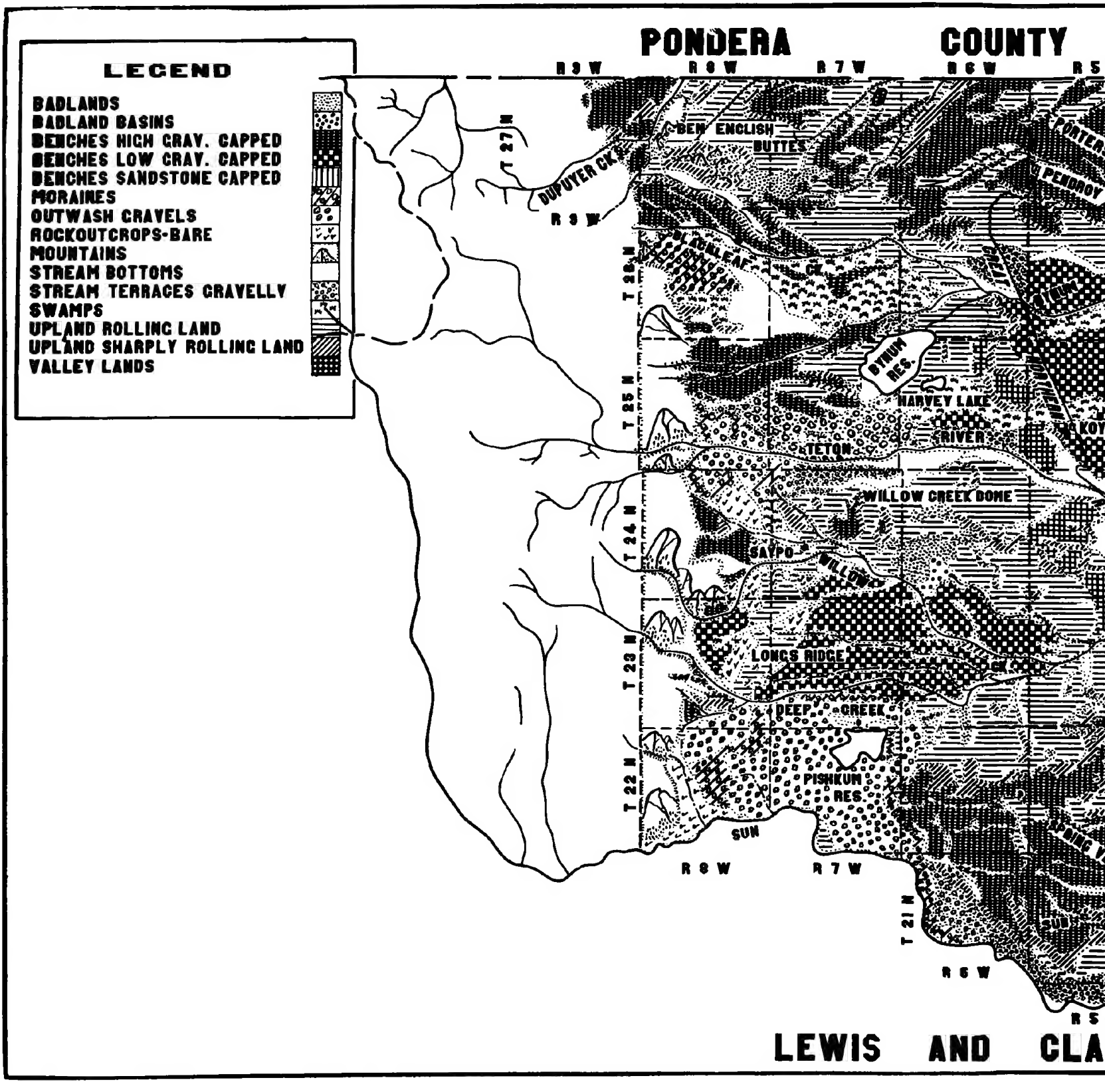
LEWIS AND CLA


LEGEND
BADLANDS
BADLAND BASINS
BENCHES HIGH GRAV. CAPPED
BENCHES LOW GRAV. CAPPED
BENCHES SANDSTONE CAPPED
MORAINES
OUTWASH GRAVELS
ROCKOUTCROPS-BARE
MOUNTAINS
STREAM BOTTOMS
STREAM TERRACES GRAVELLY
SWAMPS
UPLAND ROLLING LAND
UPLAND SHARPLY ROLLING LAND
VALLEY LANDS
PONDERA COUNTY
R9W
R8W
R7W
R6W
R5
T 27 N
DUPUYER CK.
BEN ENGLISH BUTTES
PORTER
PENDROY
T 26 N
BLACKLEAF CK.
T 25 N
BYNUM RES.
HARVEY LAKE
TETON
RIVER
WILLOW CREEK DOME
T 24 N
SAYPO
WILLOW
T 23 N
LONGS RIDGE
DEEP CREEK
T 22 N
PISHKUN RES.
SUN
R8W
R7W
T 21 N
R6W
R5
LEWIS AND CLA